INSTRUCTION BOOK

for

RADIO TRANSMITTER T-208/U

and

RADIO TRANSMITTER T-417/GR

KNOWLEDGE IS FREEDOM

SCPA

SIGNAL CORPS PUBLICATIONS AGENCY

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ADDENDA NO. 2
4 DECEMBER 1953

ADDENDA NO. 2 TO INSTRUCTION BOOK FOR RADIO TRANSMITTER T-208/U AND RADIO TRANSMITTER T-417/GR

The following information, published on Order No. 11661–Phila–52, provides information to be added to the instruction book. This addenda supersedes Addenda No. 1, 6 August 1953.

Personnel using this equipment and having custody of this addenda will enter suitable notations beside each affected paragraph and figure in the instruction book to indicate the presence of this supplementary information.

Change the power output rating of Radio Transmitter T–208/U (or the system in which it is used) from 30 to 25 watts in the following places in the instruction book:

Page 1. Par. 3*b*. Line 3.
Page 2. Par. 4*a*(3). Last line.
Page 4. Par. 5*b*. Last line.
Page 47. Par. 71*f*. Line 4.
Page 53. Par. 2. First item. Line 2.

Change the power output rating of Radio Transmitter T–417/GR (or the system in which it is used) from 50 to 45 watts in the following places in the instruction book:

Page 1. Par. 3*b*. Line 5.
Page 2. Par. 4*b*(3). Last line.
Page 4. Par. 5*c*. Last line.
Page 6. Par. 10*b*. Last line.
Page 47. Par. 71*f*. Line 4.
Page 53. Par. 2. Second item. Line 2.

Page 2. Par. 4*a*(3). Lines 5 and 6. Change "Dynamotor DY–93/U" to read: Dynamotor-Power Supply DY–93/G.

Page 4. Par. 5. Item 5. Make the following changes:

In line 1, change "15-kc" to read: 18-kc.
In line 2, change "15 kc" to read: 18 kc.

Page 5. Par. 7*b*. Line 5. Change "15 kc" to read: 18 kc.

Page 12. Fig. 9. Delete the ANTENNA FILTER SWITCHING decal.

Page 13. Par. 19*i*. Add the following after the second sentence in the "Adjustment" column:

Place the TUNE-OPERATE switch in the OPERATE position.

Page 14. Par. 25*b*. Change "note 5 of figure 32" to read: note 5 of figure 24.

Page 25. Par. 43. Make the following changes in subparagraph *a*.

In subparagraph *a*(2), line 4, change "(5678)" to read: (1AD4).

In subparagraph *a*(2), next to last line, change "937.5" cycles to read: 1,125.

In subparagraph *a*(3), last line, change "937.5" cycles to read: 1,125.

In subparagraph *a*(4), line 4, change "1,875" cycles to read: 2,250.

In subparagraph *a*(5), line 4, change "3,750" cycles to read: 4,500.

In subparagraph *a*(6), line 4, change "7,500" cycles to read: 9,000.

In subparagraph *a*(7), line 4, change "15,000" cycles to read: 18,000. Change "(15 kc)" to read: (18 kc).

Page 26. Par. 43. In subparagraph *b*(1), line 4, change "15 kc" to read: 18 kc.

Page 27. Fig. 16. Change the value of C303 to read: 6.5-75.

Page 28. Par. 47. Line 3. Change "937.5" cycles to read: 1,125. In line 5, change "15-kc" to read: 18-kc.

Page 28. Fig. 18. Change the value of L303 from 52 uh to 48 uh.

Page 29. Fig. 19. Make the following changes in figure 19:

Change the value of R321 from 3.6 ohms to 15 ohms.

Change the value of L307 from 2.85 uh to 2.34 uh.

Add resistor R375 (10 ohms) and resistor R376 (10 ohms) in parallel with R321.

Page 29. Par. 47*b*. Second column. Line 15. Change "Resistor R321" to read: The parallel combination of resistors R321, R375, and R376.

Page 30. Fig. 20. Delete figure 20 and insert new figure 20.

Page 31. Par. 48. In line 16, add the following after "screens for r-f": Parasitic suppressors Z307 and Z308 remove unwanted oscillations that could cause damage to the circuit.

In line 13 from bottom, change "R373" to read: R374.

Page 32. Fig. 21. Make the following changes in figure 21:

Change the value of C373 from 500 uuf to 510 uuf.

Change the value of R353 from 220K to 150K.

Change the value of R352 from 100K to 220K.

Remove terminal 1 of T301 from ground.

Indicate a connection from terminal 1 of T301 to the junction of R324 and R351.

Add "6" to the grounded terminal of T301.

Change "R374" to read: R373.

Page 33. Par. 52*c*. Delete subparagraph *c* and substitute the following:

c. The ungrounded side of R351 (+2 volts) is connected to terminal 1 of T301. The 2-volt potential is applied through external connections to the microphone circuit of the handset.

Page 33. Par. 54*b*. Next to last line. Change "HR301" to read: E301.

Page 34. Fig. 22. Delete figure 22 and insert new figure 22.

Page 35. Fig. 23. Make the following changes in 3D DOUBLER V307:

Change the value of R321 from 3.6 ohms to 15 ohms.

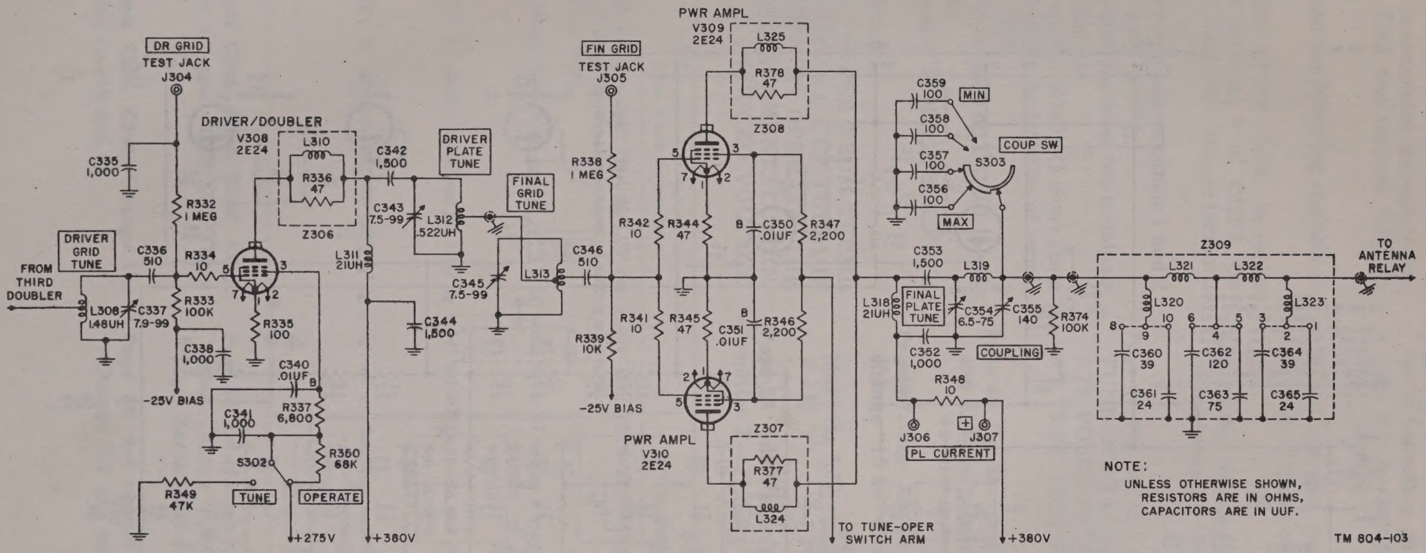
Add resistor R375 (10 ohms) and resistor R376 (10 ohms) in parallel with R321.

Page 36. Par. 54. Make the following changes in paragraph 54:

In subparagraph *d*(2), delete the last three sentences and substitute the following: A +2 volt dc potential also is supplied by the divider network to terminal 1 of T301 for voice operation of the handset. This voltage is applied through the series connection consisting of terminals 1 and 3 of T301, through terminal 13 of P301, and through an external circuit which passes through the handset microphone to ground.

In subparagraph *d*(4), line 1, change "180" to read: 275.

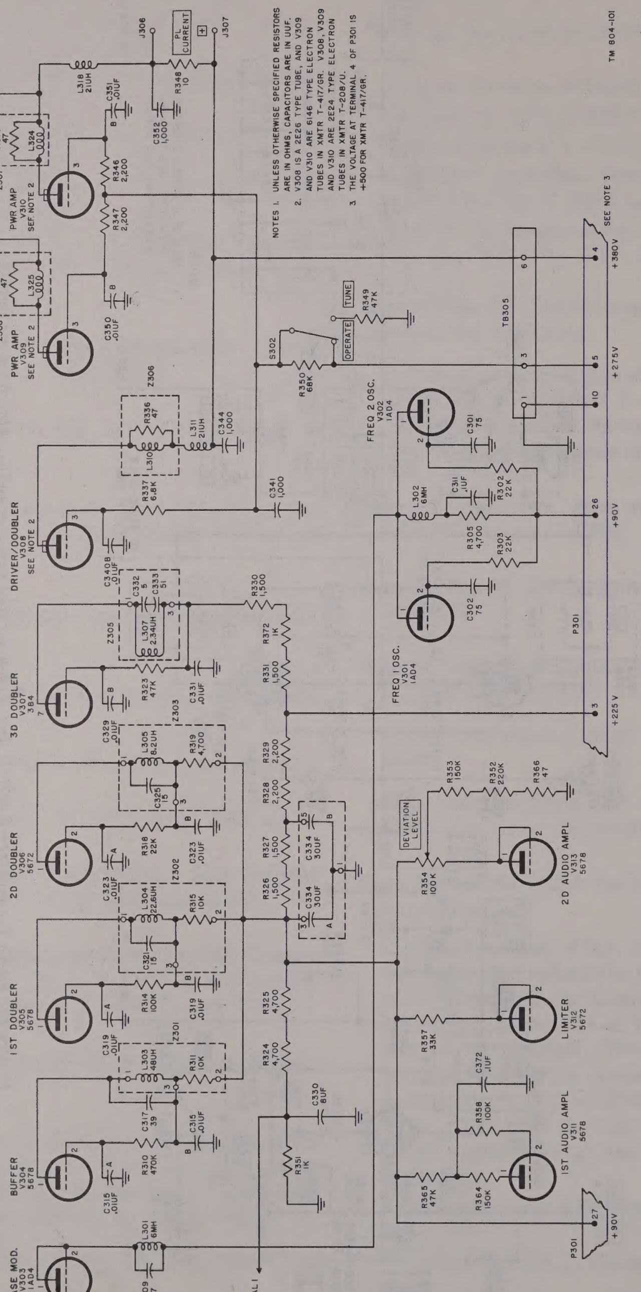
In subparagraph *f*, change "+450" to read: +500.


DR GRID
TEST JACK
J304
DRIVER/DOUBLER
V308
2E24
L310
R336
47
Z306
C342
1,500
DRIVER
PLATE
TUNE
FINAL
GRID
TUNE
C335
1,000
R332
1 MEG
DRIVER
GRID
TUNE
FROM
THIRD
DOUBLER
C336
510
R334
10
L308
1.48UH
C337
7.9-99
R333
100K
C338
1,000
-25V BIAS
R335
100
C340
.01UF
B
R337
6,800
C341
1,000
S302
R350
68K
R349
47K
TUNE
OPERATE
+275V
L311
21UH
C343
7.5-99
L312
.522UH
C344
1,500
+380V
C345
7.5-99
L313
C346
510
FIN GRID
TEST JACK
J305
R338
1 MEG
R339
10K
-25V BIAS
PWR AMPL
V309
2E24
L325
R378
47
Z308
R342
10
R344
47
C350
.01UF
R347
2,200
R341
10
R345
47
C351
.01UF
R346
2,200
PWR AMPL
V310
2E24
Z307
R377
47
L324
TO TUNE-OPER
SWITCH ARM
C359
100
MIN
C358
100
COUP SW
C357
100
S303
C356
100
MAX
C353
1,500
L319
L318
21UH
FINAL
PLATE
TUNE
C354
6.5-75
C355
140
R374
100K
C352
1,000
COUPLING
R348
10
J306
J307
PL CURRENT
+380V
Z309
L321
L322
L320
L323
C360
39
C361
24
C362
120
C363
75
C364
39
C365
24
TO
ANTENNA
RELAY

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

TM 804-103

Figure 20. Radio Transmitter T–208/U driver/doubler and power amplifier, simplified schematic.


PHASE MOD.
V303
1AD4
BUFFER
V304
5678
1ST DOUBLER
V305
5678
2D DOUBLER
V306
5672
3D DOUBLER
V307
3B4
DRIVER/DOUBLER
V308
SEE NOTE 2
PWR AMP
V309
SEE NOTE 2
PWR AMP
V310
SEE NOTE 2
Z308
Z307
R378
47
L325
R377
47
L324
L318
21UH
C351
.01UF
C352
1,000
J306
PL CURRENT
+
J307
R348
10
R346
2,200
R347
2,200
C350
.01UF
Z306
R336
47
L310
L311
21UH
C344
1,000
R337
6.8K
C341
1,000
S302
TUNE
OPERATE
R349
47K
R350
68K
C3408
.01UF
C332
5
C333
51
Z305
L307
2.34UH
R330
1,500
R372
1K
R323
47K
C331
.01UF
R351
1,500
Z303
C329
.01UF
L305
6.2UH
R319
4,700
C325
15
R329
2,200
R328
2,200
R318
22K
C323
.01UF
Z302
C323
.01UF
L304
22.6UH
R315
10K
C321
15
R327
1,500
C334
30UF
R326
1,500
C334
30UF
R314
100K
C319
.01UF
Z301
C319
.01UF
L303
48UH
R311
10K
R325
4,700
R324
4,700
C317
39
C315
.01UF
R310
470K
C315
.01UF
C330
8UF
R351
1K
L301
6MH
C309
27
TO TERMINAL 1
OF T301
FREQ 2 OSC.
V302
1AD4
FREQ 1 OSC.
V301
1AD4
C301
75
C302
75
L302
6MH
C311
.1UF
R302
22K
R305
4,700
R303
22K
TB305
P301
+225 V
+90V
+275V
+380V
SEE NOTE 3
DEVIATION LEVEL
R353
150K
R352
220K
R366
47
R354
100K
2D AUDIO AMPL
V313
5678
R357
33K
LIMITER
V312
5672
C372
.1UF
R358
100K
R365
47K
R364
150K
1ST AUDIO AMPL
V311
5678
P301
+90V
TM 804-101

NOTES 1. UNLESS OTHERWISE SPECIFIED RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

2. V308 IS A 2E26 TYPE TUBE, AND V309 AND V310 ARE 6146 TYPE ELECTRON TUBES IN XMTR T-417/GR. V308, V309 AND V310 ARE 2E24 TYPE ELECTRON TUBES IN XMTR T-208/U.

3. THE VOLTAGE AT TERMINAL 4 OF P301 IS +500 FOR XMTR T-417/GR.

Figure 22. Radio Transmitter T-208/U and T-417/GR, B+ distribution, simplified schematic.

Page 37. Par. 55*b*. Change the last sentence to read: The circuit is completed through terminals 3 and 1 of T301 and through R351 to ground.

Page 37. Fig. 24. Make the following changes in figure 24:

Add resistor R1208 (1,200 ohms) in series with R1209 and terminal 9 of P1203. On P1203, J801, J802, and P301, change terminal "9" to read: 3.
On relay K1201 circuit, add terminals 1 and 2 of TB1201 below relay K1201.
Add a dashed line between these two terminals to indicate a wire jumper.
Add and connect resistor R1201 (1 ohm) from terminal 1 of TB1201 to the junction of terminals 2 and 7 of K1201.
Add a lead from terminal 2 of TB1201 to terminal 8 of K1201.
Below the jumper add "JUMPER SEE NOTE 5."
Add the following note.

5. CONNECT A JUMPER FROM TERMINAL 1 TO TERMINAL 2 OF TB1201 IF IT IS DESIRED TO OPERATE THE TRANSMITTER FILAMENTS CONTINUOUSLY AT A REDUCED VOLTAGE.

Page 40. Make the following changes in the trouble-shooting chart: In "Correction" column, line 5, change "Repair and adjust" to read: Replace.

In the last line, change "Repair and adjust" to read: Replace.

Page 42. Par. 62. Step No. 11, item 3 in "Trouble" column. Change "R373" to read: R374.

Page 44. Fig. 25. Add the following to NOTE 1: TUNE-OPERATE SWITCH S302 IN OPERATE POSITION, TEST-OFF SWITCH S301 AT TEST POSITION.

Page 45. Fig. 26. On TB304, add resistors R375 and R376 in parallel with R321.

Page 47. Par. 72. In subparagraph *c*, line 3, change "15 kc" to read: 18 kc.

Make the following changes in appendix II:

Page 53. Add the following after Radio Transmitter T–417/GR:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E317	ADAPTER, crystal socket: Plaskon; 1.25″ dia; x .937″ thk; marked "1" and "2"; 3 male pin term., 1 spring wire term. and 4 female term.	Crystal oven adapter.	
H388	BLOCK, spacing: Zamak #2, cad pl; ½″ lg x ¼″ wd x 7⁄16″ h o/a.	Used as a spacing block in handle of lock-in assembly.	
A 314, A 315	BRACKET: "L" shape; steel, cad pl; 1 13⁄16″ lg x ⅜″ wd x ½″ d.	Supports one end of terminal boards TB301 and TB302.	
A 316, A 317	BRACKET: "L" shape; steel, cad pl; 2⅛″ lg x ⅜″ wd x 9⁄16″ d.	Supports one end of terminal boards TB303 and TB304.	

Page 54. Ref symbols C335, C344, C348, C352. Change the value to read: 1000 uuf +50% –20%.

Page 55. Ref symbols C336, C346. Change the value from 500 uuf to 510 uuf.

Page 56. Ref symbols H301, H371, H372, H345, and H346. Change "ethyl cellulose acetate" to read: black Saran plastic.

Page 56. Ref symbol Z301. Description column. Change "52 uh" to read: 48 uh.

Page 56. Add the following after Item H346:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E362 thru E366	CLIP, electrical: brass; 1″ lg x $\frac{3}{8}$″ wd.	Holder for hexagon socket setscrew wrench.	

Page 57. Ref symbol Z305. Description column. Change "2.85 uh" to read: 2.34 uh.

Page 57. Ref symbols E337, E338. Change "39/64″ lg x 21/64″ dia; 50 ohms" to read: 31/32″ lg x 27/64″ dia o/a; 52 ohms.

Page 57. Add the following after Item O 303:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
A 304	COVER, radio transmitter: aluminum alloy; $13\frac{21}{32}$″ lg x $7\frac{11}{64}$″ wd x $\frac{9}{32}$″ thk.	Dust cover for left side of transmitter.	
A 306	COVER, radio transmitter: aluminum alloy; $13\frac{21}{32}$″ lg x $7\frac{11}{64}$″ wd x $\frac{9}{32}$″ thk.	Dust cover for right side of transmitter.	
A 308	COVER, radio transmitter: aluminum alloy; 12.875″ lg x 3.562″ wd x .05″ thk.	Dust cover for bottom of transmitter.	

Page 58. In the "Ref symbol" column, after R364, add R353.

In the "Function of part" column, after R364, add the following: R353: Deviation level limiting.

Page 58. In the "Ref symbol" column, delete R312.

In the "Function of part" column, delete the following: "R312: V305 control grid limiting."

Page 58. Ref symbol R308. Description column. Change "10%" to read: 5%, and change the stock No. to read: 3RC20BF334J.

Page 58. Add the following after Item V310.

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H387	HANDLE: zinc alloy; cad pl; 3″ lg x 2″ wd x $\frac{13}{32}$″ thk o/a.	Handle for lock-in assembly.	
E309	HOUSING: steel, rectangular shape; $4\frac{3}{8}$″ lg x $1\frac{1}{2}$″ wd x $\frac{7}{8}$″ h o/a.	Antenna filter housing.	
E329	INSULATION, sheet: electrical; brown phenolic; $1\frac{1}{2}$″ wd x $5\frac{3}{8}$″ lg x $\frac{1}{32}$″ thk.	Insulator between terminal boards TB301 and TB302.	
E331 thru E336	INSULATION, tape: electrical; fiberglass cloth; 1.75″ wd x 2.218″ lg x .005″ thk.	Insulates coil from shield.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E330	INSULATOR, plate: electrical; brown phenolic; 4″ lg x 1¾″ wd x 1⁄32″ thk.	Insulator between terminal boards TB303 and TB304.	
O 307 thru O 310	INSULATOR, spacer: black Formica; cylindrical shape; MBCA ref dwg group 9 dimen, C— .136″, D— .25″, L— .25″.	O 307, O 308: Spacer for choke coil L311. O 309, O 310: Spacer for choke coil L318.	

Page 58. Add the following after Item E321:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
A 310	MOUNTING: steel; electro-tin plate finish; two No. 6–32 threaded clinch nuts on 1″ mtg ctr.	Switch S303 mounting bracket.	

Page 58. Add the following after Item A 311:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
A 301	MOUNTING, coil: aluminum alloy; "L" shape; 1¼″ lg x 1 13⁄16″ h x 11⁄16″ d o/a; two mtg holes .188″ dia spaced .625″ C to C.	Mounts coil.	

Page 58. Add the following after Item A 312:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H389	PIN, drive: steel; cad pl; ⅞″ lg x ⅛″ dia o/a.	Mounts handle on lock-in rod.	
H312 thru H317, H324 thru H329, H335 thru H339, H353, H354	PIN, locking: steel; peg shape; .3125″ lg x .061″ dia.	Locking pin for airloc fastener.	
A 303	PLATE, cover: steel, cad pl; rectangular shape; 13 27⁄32″ lg x 4¼″ wd x 7⁄16″ h o/a.	Top cover plate.	
H385	PLATE, detent: steel; washer shape; 1″ dia x ⅛″ thk o/a.	Part of lock-in assembly.	
H384	PLUNGER: steel; cylindrical shape; 7⁄16″ lg x .18″ dia o/a.	Part of lock-in assembly.	

Page 58. Add the following after Item K301:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R321	RESISTOR, fixed: comp; 15 ohms ±10%; 1 w.	1.25V filament voltage-dropping resistor.	3RC30BF150K.

Page 58. Add the following after Item R362:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R312	RESISTOR, fixed: comp; 1 meg ±5%; ½ w.	V305 control grid limiting.	3RC20BF105J.

Page 59. In the "Ref symbol" column, after R342, add R375 and R376.

In the "Ref symbol" column, transpose Ref symbols R373 and R374.

In the "Function of part" column, transpose Ref symbols R373 and R374.

In the "Function of part" column, after R342, add the following: R375, R376: 1.25V filament voltage-dropping resistors.

Page 60. In the "Ref symbol" column, after R369, add R352.

In the "Function of part" column, after R369, add the following: R352: Part of V313 output circuits.

Page 60. In the "Ref symbol" column, delete R353.

In the "Function of part" column, delete the following: R353: Deviation level limiting.

Page 61. Add the following after Item H360:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H373 thru H381	RING, retainer: brass; rectangular; .423″ lg x .23″ wd x .05″ thk.	Holds tube socket in chassis.	
H382	ROD, locking: steel; cad pl; 15.632″ lg x 1″ dia o/a.	Part of lock-in assembly.	

Page 61. In the "Ref symbol" column, after Item E310, add: E367.

Page 61. Add the following after Item XV313:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H383	SPRING: helical compression type; .03″ dia steel music wire; .5″ lg x .18″ max dia o/a.	Part of lock-in assembly.	

Page 62: In the "Ref symbol" column, change "Z306" to read: Z306, Z307, Z308.

In the "Function of part" column, add Z306 in front of the information for Z306.

Add Z307: Parasitic suppressor V310 plate circuit.

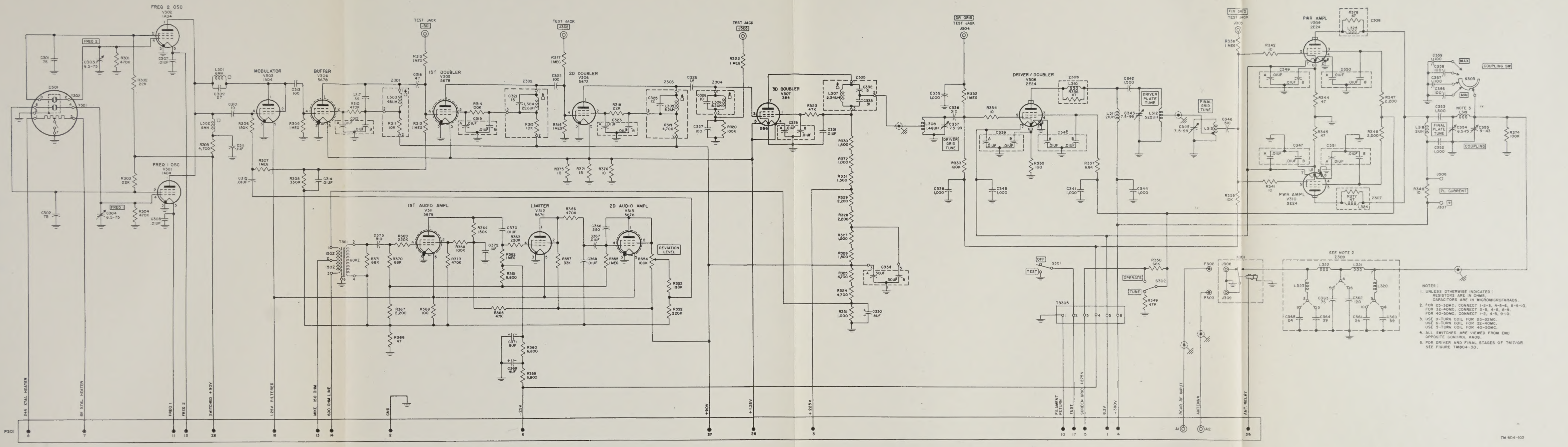
Add Z308: Parasitic suppressor V309 plate circuit.

Page 63. Add the following after Item T301:

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H386	WASHER, flat: round; brass; .031″ nominal thk.	Part of lock-in assembly.	

Page 71. Fig. 31. Delete figure 31 and insert new figure 31.

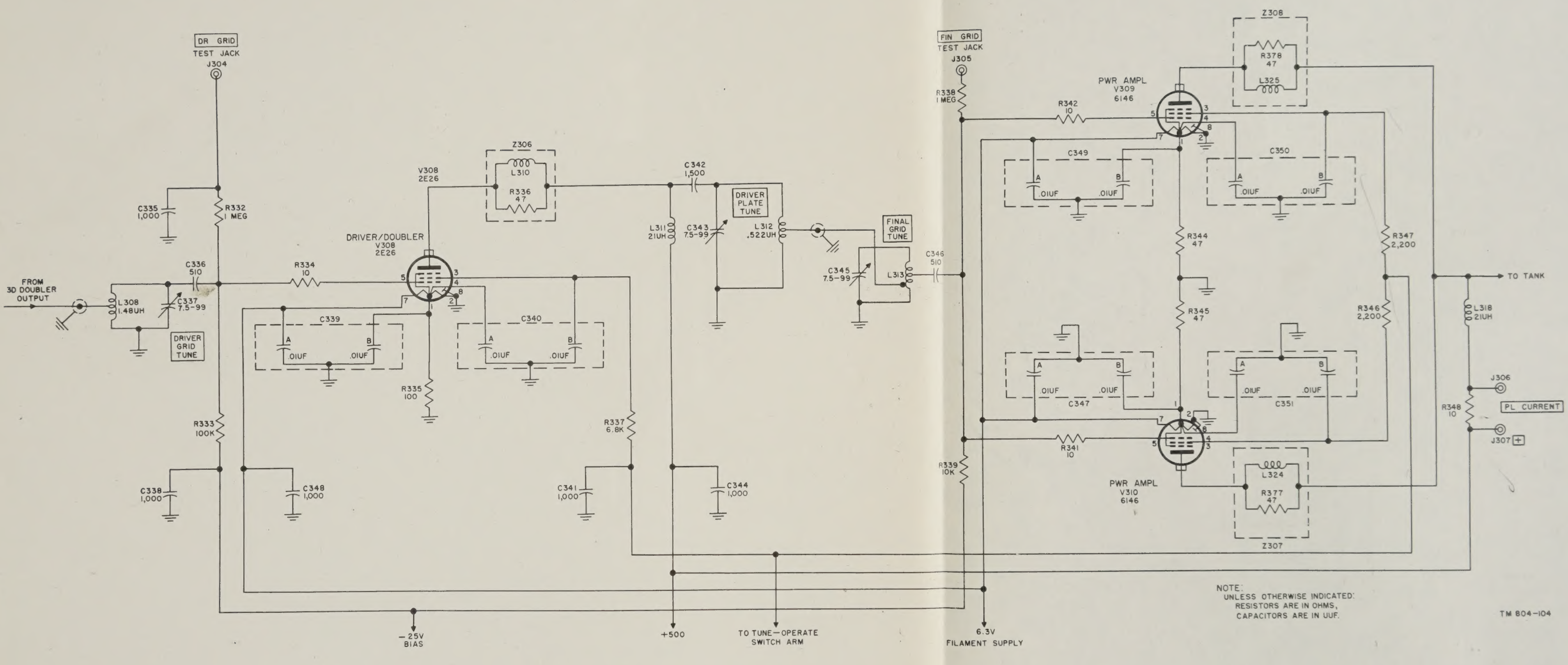
Page 73. Fig. 32. Delete figure 32 and insert new figure 32.


FREQ 2 OSC V302 1AO4
FREQ 1 OSC V301 1AO4
E301
MODULATOR V303 1AO4
BUFFER V304 5678
1ST DOUBLER V305 5678
2D DOUBLER V306 5672
3D DOUBLER V307 384
DRIVER / DOUBLER V308 2E24
PWR AMPL V309 2E24
PWR AMPL V310 2E24
1ST AUDIO AMPL V311 5678
LIMITER V312 5672
2D AUDIO AMPL V313 5678
TEST JACK J301
TEST JACK J302
TEST JACK J303
DR GRID TEST JACK J304
FIN GRID TEST JACK J305
DRIVER GRID TUNE
DRIVER PLATE TUNE
FINAL GRID TUNE
FINAL PLATE TUNE
COUPLING SW
MAX
MIN
COUPLING
PL CURRENT
DEVIATION LEVEL
OFF
TEST
OPERATE
TUNE
S301
S302
S303
TB305
SEE NOTE 2 Z309
T301
P301
24V XTAL HEATER
6V XTAL HEATER
FREQ 1
FREQ 2
SWITCHED +90V
1.25V FILTERED
MIKE 150 OHM
600 OHM LINE
GND
-25V
+90V
+1.25V
+225V
FILAMENT RETURN
TEST
SCREEN GRID +275V
6.3V
+380V
RCVR RF INPUT
ANTENNA
ANT. RELAY
8
7
11
12
26
16
13
14
2
6
27
28
3
10
17
5
1
4
A1
A2
29
TM 804-103

NOTES:

1. UNLESS OTHERWISE INDICATED:
   RESISTORS ARE IN OHMS.
   CAPACITORS ARE IN MICROMICROFARADS.
2. FOR 25-32MC, CONNECT 1-2-3, 4-5-6, 8-9-10.
   FOR 32-40MC, CONNECT 2-3, 4-6, 8-9.
   FOR 40-50MC, CONNECT 1-2, 4-5, 9-10.
3. USE 9-TURN COIL FOR 25-32MC.
   USE 6-TURN COIL FOR 32-40MC.
   USE 5-TURN COIL FOR 40-50MC.
4. ALL SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
5. FOR DRIVER AND FINAL STAGES OF T417/GR SEE FIGURE TM804-30.

Figure 31. Radio Transmitter T-208/U and T-417/GR, schematic diagram.


DR GRID
TEST JACK
J304
FROM
3D DOUBLER
OUTPUT
L308
1.48UH
C337
7.5-99
DRIVER
GRID
TUNE
C335
1,000
R332
1 MEG
C336
510
R334
10
DRIVER/DOUBLER
V308
2E26
V308
2E26
Z306
L310
R336
47
C339
A
B
.01UF
.01UF
C340
A
B
.01UF
.01UF
R335
100
R333
100K
C338
1,000
C348
1,000
R337
6.8K
C341
1,000
C342
1,500
L311
21UH
C343
7.5-99
DRIVER
PLATE
TUNE
L312
.522UH
C344
1,000
FINAL
GRID
TUNE
C345
7.5-99
L313
C346
510
FIN GRID
TEST JACK
J305
R338
1 MEG
R339
10K
PWR AMPL
V309
6146
R342
10
Z308
R378
47
L325
C349
C350
R344
47
R345
47
C347
C351
R341
10
PWR AMPL
V310
6146
Z307
L324
R377
47
R347
2,200
R346
2,200
TO TANK
L318
21UH
J306
R348
10
PL CURRENT
J307 +
– 25V
BIAS
+500
TO TUNE—OPERATE
SWITCH ARM
6.3V
FILAMENT SUPPLY
TM 804-104

NOTE:
UNLESS OTHERWISE INDICATED:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

Figure 32. Radio Transmitter T–417/GR, driver and final stage, schematic diagram.

INSTRUCTION BOOK

for

RADIO TRANSMITTER T-208/U

and

RADIO TRANSMITTER T-417/GR

KNOWLEDGE IS FREEDOM

SCPA

SIGNAL CORPS PUBLICATIONS AGENCY

MANUFACTURED BY
MOTOROLA INCORPORATED
ORDER NO. 11661-PHILA-52-93
30 MARCH 1953

WARNING

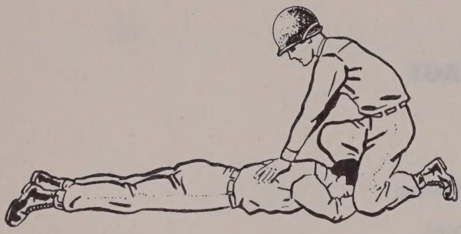
HIGH VOLTAGE

is used in the operation
of this equipment.

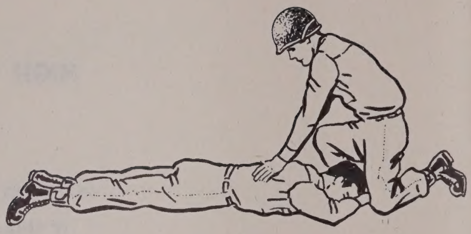
DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

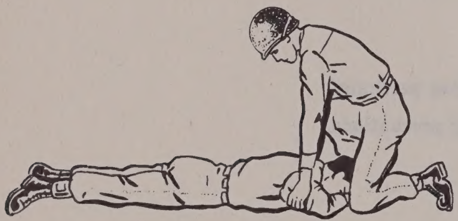
Be careful not to contact high-voltage connections or 115-volt input connections when working on or near this equipment. When working inside the equipment, after the power has been turned off, always short-circuit the high-voltage capacitors.



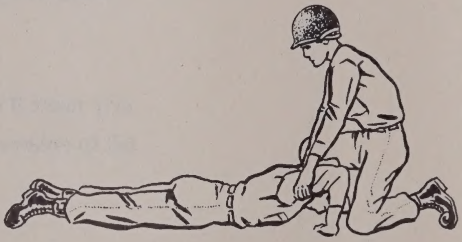
A Position of operator and victim



B Compression phase



C Expansion phase (arm lift)



D Expansion phase (arm release)

TM AR-4

ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now. repeat the cycle.

5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

6. *Changing Position or Operator.*

(*a*) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(*b*) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

CONTENTS

Paragraph *Page*

CHAPTER 1. INTRODUCTION.

Section I. General 1- 2 1
II. Description and data 3-10 1

CHAPTER 2. OPERATING INSTRUCTIONS.

Section I. Service upon receipt of equipment 11-14 7
II. Controls and instruments 15-17 8
III. Preliminary adjustments and tuning 18-19 9
IV. Operation under usual conditions 20-23 14
V. Operation under unusual conditions 24-27 14

CHAPTER 3. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS.

Section I. Organizational tools and equipment 28-29 16
II. Preventive maintenance services 30-35 16
III. Lubrication and weatherproofing 36-38 21
IV. Trouble shooting at organizational maintenance level 39-41 21
CHAPTER 4. THEORY OF OPERATION. 42-55 25

CHAPTER 5. FIELD MAINTENANCE INSTRUCTIONS.

Section I. Trouble shooting at field maintenance level 56-63 38
II. Repairs 64-66 43
III. Alinement 67-69 46
IV. Final testing 70-75 47

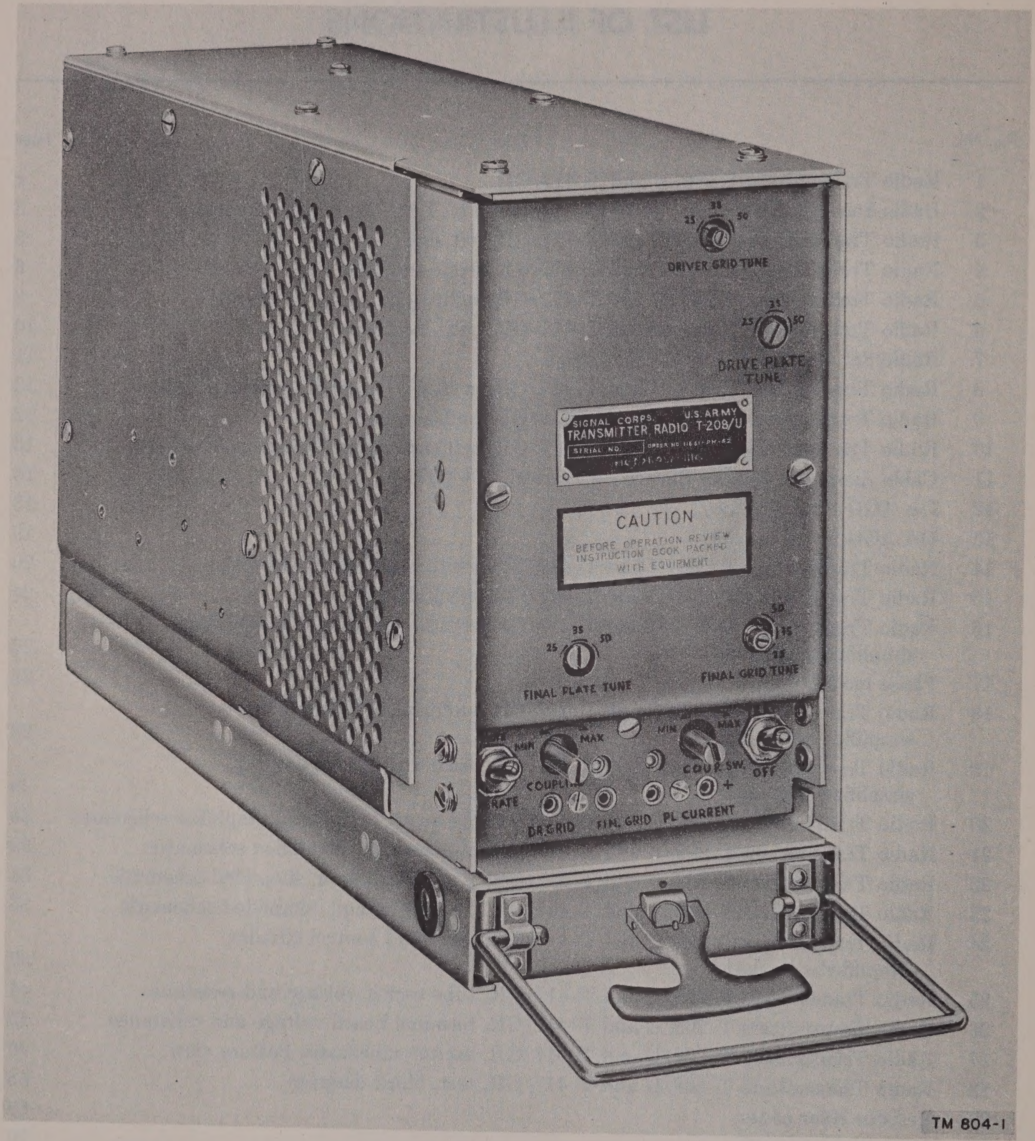
CHAPTER 6. SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE.

Section I. Shipment and limited storage 76-77 50
II. Demolition of materiel to prevent enemy use 78-79 50
APPENDIX I. REFERENCES 51
II. IDENTIFICATION TABLE OF PARTS 53
INDEX 64

LIST OF ILLUSTRATIONS

Fig. No. *Title* *Page*

1 Radio Transmitters T–208/U and T–417/GR x
2 Radio Sets AN/VRC–6(*), AN/FRC–15, and AN/TRC–22, block diagrams 3
3 Radio Transmitters T–208/U and T–417/GR, left side 5
4 Radio Transmitters T–208/U and T–417/GR, front and rear 6
5 Radio Transmitters T–208/U and T–417/GR, right side 8
6 Radio Transmitters T–208/U and T–417/GR, tube locations 10
7 Radio Set Control C–847/U, front panel 11
8 Radio Transmitters T–208/U and T–417/GR, crystal oven E301, exploded view 12
9 Radio Transmitters T–208/U and T–417/GR, bottom view 12
10 Radio Transmitters T–208/U and T–417/GR, test points and alinement locations 15
11 Cable Assembly, Special Purpose, Electrical, CX–2371/U 16
12 DA AGO Form 11–238 18
13 DA AGO Form 11–239 19
14 Radio Transmitters T–208/U and T–417/GR, front view, panel removed 20
15 Radio Transmitters T–208/U and T–417/GR, block diagram 24
16 Radio Transmitters T–208/U and T–417/GR, crystal oscillator and modulator, simplified schematic 27
17 Phase modulation 28
18 Radio Transmitters T–208/U and T–417/GR, buffer and first doubler, simplified schematic 28
19 Radio Transmitters T–208/U and T–417/GR, second and third doubler, simplified schematic 29
20 Radio Transmitters T–208/U, driver/doubler and power amplifiers, simplified schematic ... 30
21 Radio Transmitters T–208/U and T–417/GR, audio stages, simplified schematic 32
22 Radio Transmitters T–208/U and T–417/GR, B+ distribution, simplified schematic 34
23 Radio Transmitters T–208/U and T–417/GR, filament circuit, simplified schematic 35
24 Radio Transmitters T–208/U and T–417/GR, relay and control circuits, simplified schematic 37
25 Radio Transmitters T–208/U and T–417/GR, tube socket voltage and resistance 44
26 Radio Transmitters T–208/U and T–417/GR, terminal board voltage and resistance 45
27 Radio Transmitters T–208/U and T–417/GR, exciter subchassis, bottom view 46
28 Radio Transmitters T–208/U and T–417/GR, test, block diagram 48
29 Resistor color codes 69
30 Capacitor color codes 70
31 Radio Transmitters T–208/U and T–417/GR, schematic diagram 71
32 Radio Transmitter T–417/GR, driver and final stages, schematic diagram 73


DRIVER GRID TUNE
DRIVE PLATE TUNE
SIGNAL CORPS. U.S. ARMY
TRANSMITTER, RADIO T-208/U
SERIAL NO.
CAUTION
BEFORE OPERATION REVIEW INSTRUCTION BOOK PACKED WITH EQUIPMENT
FINAL PLATE TUNE
FINAL GRID TUNE
MIN
MAX
COUPLING
COUP. SW.
OFF
DR.GRID
FIN. GRID
PL CURRENT
TM 804-1

'adio Transmitter T–208/U and Radio Transmitter T–417/GR.

Note. This instruction book will be replaced by TM 11-804 which, when published, will be listed in SR 310-20-4.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope.

a. This instruction book contains the necessary information for the installation, operation, maintenance, and repair of Radio Transmitter T-208/U and Radio Transmitter T-417/GR (fig. 1). In addition, there are two appendixes covering a list of references and an identification table of parts. Basic nomenclature followed by (*) is used to indicate all models of an item of equipment in this publication.

b. The two transmitters will be discussed simultaneously. Specific differences will be shown only where appropriate. Transmitter operation is developed on the basis of Radio Transmitter T-208/U as used in the mobile system of Radio Set AN/VRC-6(*).

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. USAF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

d. DA AGO Form 11-238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 12).

e. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 13).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Transmitter T-208/U is an f-m (frequency-modulated) radio transmitter designed for mobile use. Radio Transmitter T-417/GR operates from a fixed station. Both transmitters (fig. 1) are intended for use in system application, to provide point-to-point, two-way communication or radio-relay service by retransmission.

b. Both transmitters cover a frequency range of 25 to 50 mc (megacycles), with a nominal power output of 30 watts for Radio Transmitter T-208/U which is powered from a d-c (direct-current) source, and 50 watts for Radio Transmitter T-417/GR which is powered from an a-c (alternating-current) source. Radio Transmitter T-417/GR is used as an exciter for Radio Frequency Amplifier AM-495/GR providing a power output of 250 watts. Provision is made for dual frequency operation by the selection of either of two preset crystal-controlled frequencies.

c. Neither transmitter is self-contained but must be used in conjunction with a system. The transmitters are supplied by the system with sufficient running spares and operating equipment for field use.

4. System Application

a. Radio Transmitter T–208/U Used with Radio Set AN/VRC–6(*) (fig. 2).

(1) This application (fig. 2) provides ordinary single-channel simplex voice communication between two points. Simplex operation means two-way communications between two points, but in only one direction at a time. While the operator at one station is transmitting, his receiver is inoperative and the other station cannot break in. Pressing the push-to-talk switch on the handset operates the transmitter; releasing the switch makes the receiver operative. Only one antenna is used in simplex operation.

(2) The use of separate antennas for the transmitter and the receiver provides for radio-relay facilities. Signals picked up by the radio receiver at one frequency serve to modulate the transmitter, which will retransmit the signal on another frequency.

(3) The transmitter is housed in Electrical Equipment Cabinet CY–938/VRC with a transmitter power supply and the complete Radio Receiver R–257/U. Any one of the power supplies, Dynamotor DY–93/U, Dynamotor-Power Supply DY–98/G, or Dynamotor-Power Supply DY–100/U, may be used. The power supplies are intended for mobile operation, and receive their input power from a 6-, 12-, or 24-volt battery. Radio Set Control C–847/U is used to control both the receiver and the transmitter. Push-to-talk operation is provided by Handset H–33/PT. The power output of this system is 30 watts.

b. Radio Transmitter T–417/GR Used With Radio Set AN/FRC–15 (fig. 2).

(1) This application (fig. 2) provides single-channel simplex voice communication, with either local or remote control. Radio-relay operation by retransmission is possible by providing a separate antenna for the radio receiver. The system is designed for fixed station operation.

(2) The use of an additional radio receiver provides dual-channel duplex communication between two points. This arrangement uses two operating frequencies. It normally provides one voice channel in each direction. Communication can take place in both directions simultaneously, enabling the operators to talk to each other as in normal conversation.

(3) The transmitter is housed in Electrical Equipment Cabinet CY–1221/G with a transmitter power supply, two complete Radio Receivers R–257/U, and a local control unit. A remote control unit is connected externally. Push-to-talk operation is provided by the handset. The power output of the system is 50 watts.

c. Radio Transmitter T–417/GR Used with Radio Set AN/TRC–22 (fig. 2).

(1) This application (fig. 2) is for fixed station operation and provides both simplex and duplex single-channel voice communication with either local or remote control. Radio-relay service by retransmission is also available.

(2) The transmitter is housed in Electrical Equipment Cabinet CY–1221/G with a transmitter power supply, two complete Radio Receivers R–257/U, and a local control unit. A remote control unit is connected externally. With this system, an r-f (radio-frequency) power amplifier and its power supply are included to increase the over-all power output to 250 watts.

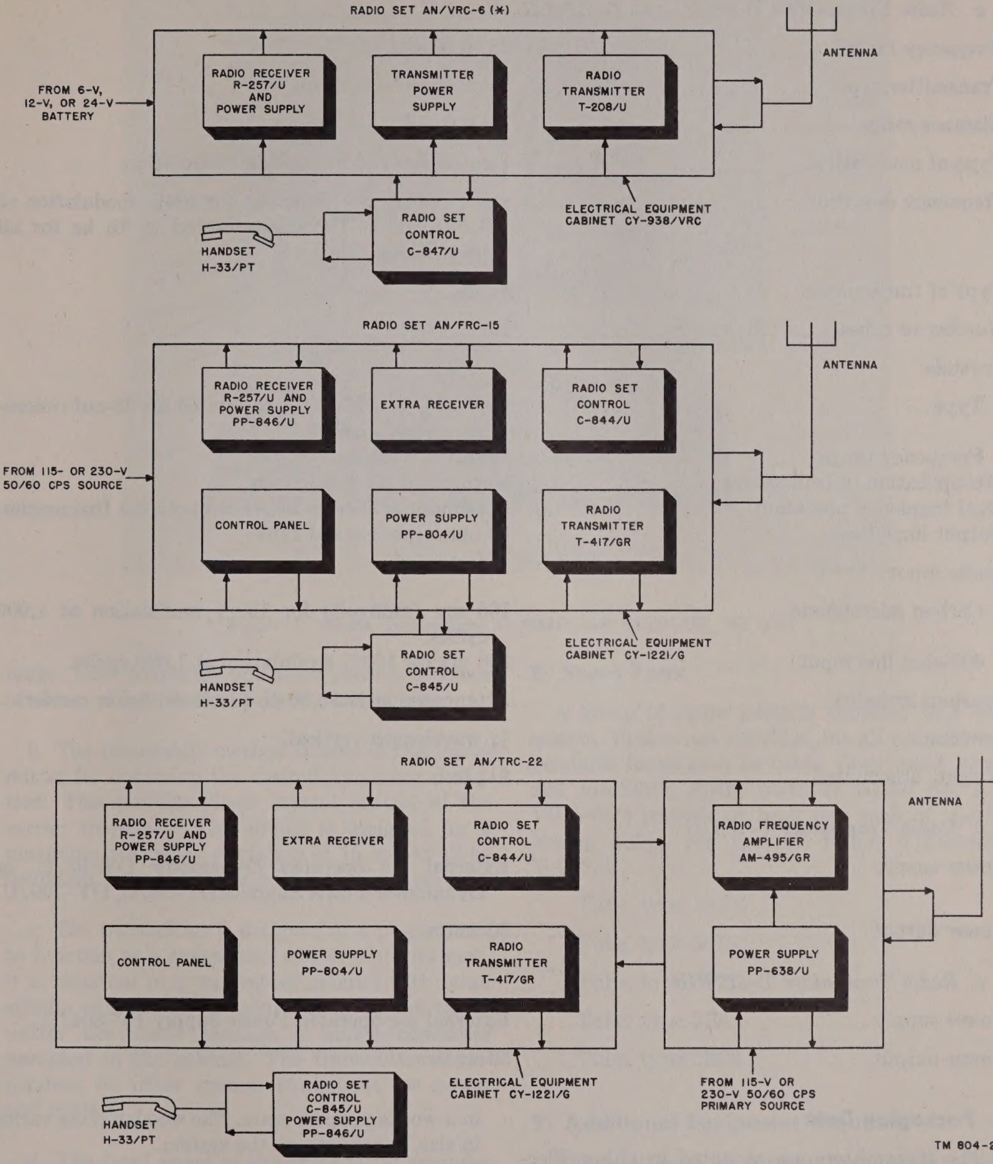

RADIO SET AN/VRC-6 (*)
ANTENNA
FROM 6-V, 12-V, OR 24-V BATTERY
RADIO RECEIVER R-257/U AND POWER SUPPLY
TRANSMITTER POWER SUPPLY
RADIO TRANSMITTER T-208/U
RADIO SET CONTROL C-847/U
HANDSET H-33/PT
ELECTRICAL EQUIPMENT CABINET CY-938/VRC
RADIO SET AN/FRC-15
ANTENNA
RADIO RECEIVER R-257/U AND POWER SUPPLY PP-846/U
EXTRA RECEIVER
RADIO SET CONTROL C-844/U
FROM 115- OR 230-V 50/60 CPS SOURCE
CONTROL PANEL
POWER SUPPLY PP-804/U
RADIO TRANSMITTER T-417/GR
RADIO SET CONTROL C-845/U
HANDSET H-33/PT
ELECTRICAL EQUIPMENT CABINET CY-1221/G
RADIO SET AN/TRC-22
ANTENNA
RADIO RECEIVER R-257/U AND POWER SUPPLY PP-846/U
EXTRA RECEIVER
RADIO SET CONTROL C-844/U
RADIO FREQUENCY AMPLIFIER AM-495/GR
CONTROL PANEL
POWER SUPPLY PP-604/U
RADIO TRANSMITTER T-417/GR
POWER SUPPLY PP-638/U
RADIO SET CONTROL C-845/U POWER SUPPLY PP-846/U
HANDSET H-33/PT
ELECTRICAL EQUIPMENT CABINET CY-1221/G
FROM 115-V OR 230-V 50/60 CPS PRIMARY SOURCE
TM 804-2

Figure 2. Radio Sets AN/VRC-6(*), AN-FRC-15, and AN/TRC-22, block diagram.

5. Technical Characteristics

a. Radio Transmitters T–208/U and T–417/GR.

Frequency range	25 to 50 mc.
Transmitter type	Crystal-controlled f-m.
Distance range	Line of sight.
Type of modulation	F-m, as derived from phase modulation.
Frequency deviation	15-kc (kilocycles) deviation for 100% modulation at 1,000 cycles. Deviation limited to 15 kc for all frequencies.
Type of transmission	Voice.
Number of tubes	13.
Crystals:	
Type	Crystal Unit CR–27/U, calibrated for 32-uuf (micro-microfarad) circuit.
Frequency range	1562.5 to 3125 kc.
Multiplication in transmitter	16 times on all frequencies.
Dual frequency operation	Maximum of 250 kc between operating frequencies.
Output impedance	50 ohms into coaxial cable.
Audio input:	
Carbon microphone	100 mv (millivolt) for 100% modulation at 1,000 cycles.
600-ohm line input	200 mv for 100% modulation at 1,000 cycles.
Spurious emission	Attenuated at least 70 db (decibels) below carrier.
Antenna	¼ wavelength vertical.
Weight, unmounted	8½ lb.

b. Radio Transmitter T–208/U

Power supply	External d-c operated Dynamotor DY–93/U, or Dynamotor-Power Supplies DY–98/G, DY–100/U.
Power output	30 watts.

c. Radio Transmitter T–417/GR

Power supply	External a-c operated Power Supply PP–804/U.
Power output	50 watts.

6. Packaging Data

The transmitters are mounted in either Electrical Equipment Cabinet CY–938/VRC or Electrical Equipment Cabinet CY–1221/G, depending on the system application (par. 4). When packaged for export shipment, the cabinet is placed in a moisture-vaporproof container and is packed in a wooden export crate. The wooden crate varies in size, depending on the system.

7. Description of Transmitter

a. Radio Transmitter T–208/U or T–417/GR (fig. 1) is a crystal-controlled f-m transmitter, capable of operation in the 25 to 50 mc frequency

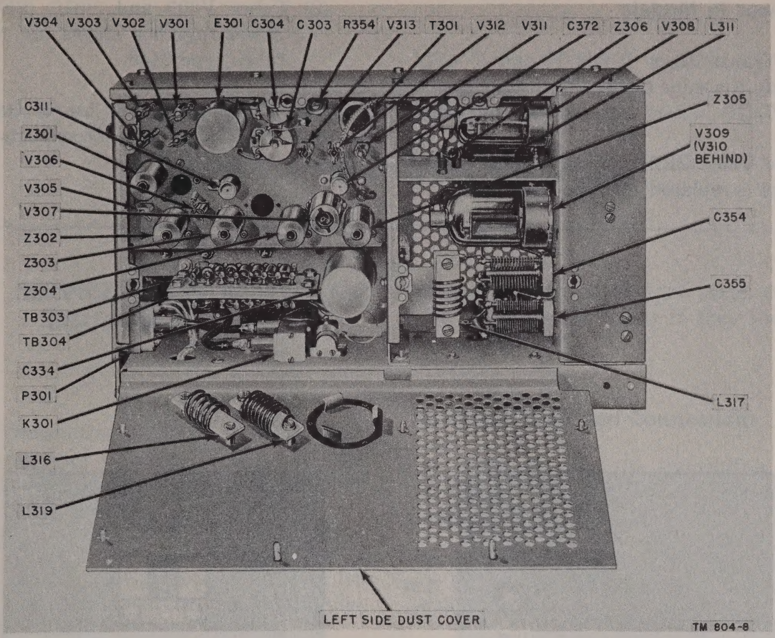

V304
V303
V302
V301
E301
C304
C303
R354
V313
T301
V312
V311
C372
Z306
V308
L311
C311
Z301
V306
V305
V307
Z302
Z303
Z304
TB303
TB304
C334
P301
K301
L316
L319
Z305
V309
(V310
BEHIND)
C354
C355
L317
LEFT SIDE DUST COVER
TM 804-8

Figure 3. Radio Transmitters T–208/U and T–417/GR, left side.

range. Dual frequency operation permits a choice of either of two preset operating frequencies.

b. The phase-shift method is used in the transmitter for obtaining the desired frequency deviation. This permits direct crystal control of the carrier frequency. The circuit is designed for a maximum frequency deviation of 15 kc. At 12-kc deviation, the distortion is less than 10 percent.

c. The transmitter is designed as a plug-in unit to function as a component of a system. As such, it is mounted in a waterproof cabinet with other system equipment. All connections to the transmitter are made through a single connector mounted in the cabinet. The transmitter is dependent on other system equipment for power and control.

d. The front panel of the transmitter provides controls for tuning, and test point jacks to provide a means of connecting a meter for visual indication during the tuning procedure. Over-all dimensions of the transmitter are $8\frac{9}{16}$ inches high, $4\frac{1}{2}$ inches wide, and $14\frac{1}{2}$ inches deep

8. Spare Parts.

A group of spare parts is supplied with each system. Spares are provided for all normally expendable items such as tubes, fuses, pilot lamps, and vibrators. Spare parts of Radio Set AN/VRC–6(*) provide at least one each of the following tubes for use in Radio Transmitter T–208/U.

Tube, type 1AD4.
Tube, type 5678.
Tube, type 5672.
Tube, type 3B4.
Tube, type 2E24.

9. Additional Equipment Required

The additional equipment required for Radio Transmitters T–208/U and T–417/GR is provided when it is installed for system operation, except for the primary source of power. Because the units are interconnected, all components comprising a system are required.

10. Differences in Models

(fig. 3)

a. Radio Transmitters T–208/U and T–417/GR are exactly the same externally. Radio Transmitter T–417/GR differs only in the following respects:

(1) Tube V308 (2E24) in the driver-doubler stage is replaced by tube type 2E26.

(2) Tubes V309 and V310 (2E24) in the power-amplifier stages are replaced by tubes type 6146.

b. These changes permit use of Radio Transmitter T–417/GR in different systems to produce a 50-watt output.

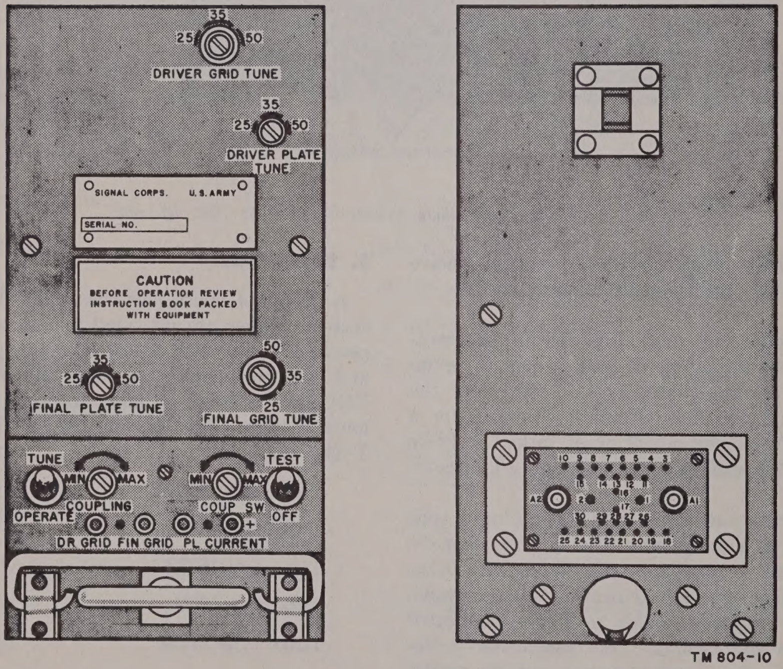

35
25
50
DRIVER GRID TUNE
DRIVER PLATE TUNE
SIGNAL CORPS. U.S. ARMY
SERIAL NO.
CAUTION
BEFORE OPERATION REVIEW INSTRUCTION BOOK PACKED WITH EQUIPMENT
FINAL PLATE TUNE
FINAL GRID TUNE
TUNE
MIN
MAX
COUPLING
OPERATE
TEST
COUP SW
OFF
+
DR GRID FIN GRID PL CURRENT
A2
A1
TM 804-10

Figure 4. Radio Transmitters T–208/U and T–417/GR. front and rear.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

11. Siting

a. Radio Transmitter T–208/U is mounted in Electrical Equipment Cabinet CY–938/VRC for use in the mobile system of Radio Set AN/VRC–6(*).

b. Radio Transmitter T–417/GR is mounted in Electrical Equipment Cabinet CY–1221/G for use in the fixed station system of Radio Set AN/FRC–15 or Radio Set AN/TRC–22.

c. The location of the transmitter is fixed within the system and siting is covered in the individual system instruction books.

12. Uncrating, Unpacking, and Checking New Equipment

a. Remove all the packing material from the cabinet containing the transmitter.

b. Release the latches on top of the cabinet and remove the cover.

c. Release the transmitter from the cabinet by turning the hold-in lock counterclockwise (fig. 4). This action will start to move the transmitter out of the cabinet and should be continued until further movement of the transmitter stops. The transmitter then may be pulled out of the cabinet, using the handle located on the front panel.

d. Inspect the pins on the plug located behind the transmitter (fig. 4), to be certain that none have been bent or damaged in shipment.

e. Remove the right and left side dust covers from the transmitter to check for damaged tubes, resistors, broken leads, bent parts, etc. See that all tubes are seated firmly in their proper sockets (figs. 3, 5, and 6).

13. Installation and Connections

a. After checking the transmitter, reassemble the dust covers and slide the transmitter upon the guide rails in the cabinet.

b. Push back firmly, without forcing or bumping the transmitter against the back of the cabinet.

c. Turn the hold-in lock clockwise until the transmitter is seated securely in place. This action will engage plug P301 on the back of Radio Transmitter T–208/U to jack J801 of cabinet CY–938/VRC. In Radio Transmitter T–417/GR, plug P301 makes contact with jack J1904 of Electrical Equipment Cabinet CY–1221/G. These plug-in connectors make all the necessary connections to the transmitter.

14. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 12 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in wiring of the equipment. If any changes have been made, note the changes in this instruction book, preferably on the schematic diagrams. If no tags are found, make the operational test described in paragraph 41 to ascertain that the equipment is functioning properly.

c. Perform the installation and connection procedure outlined in paragraph 13.

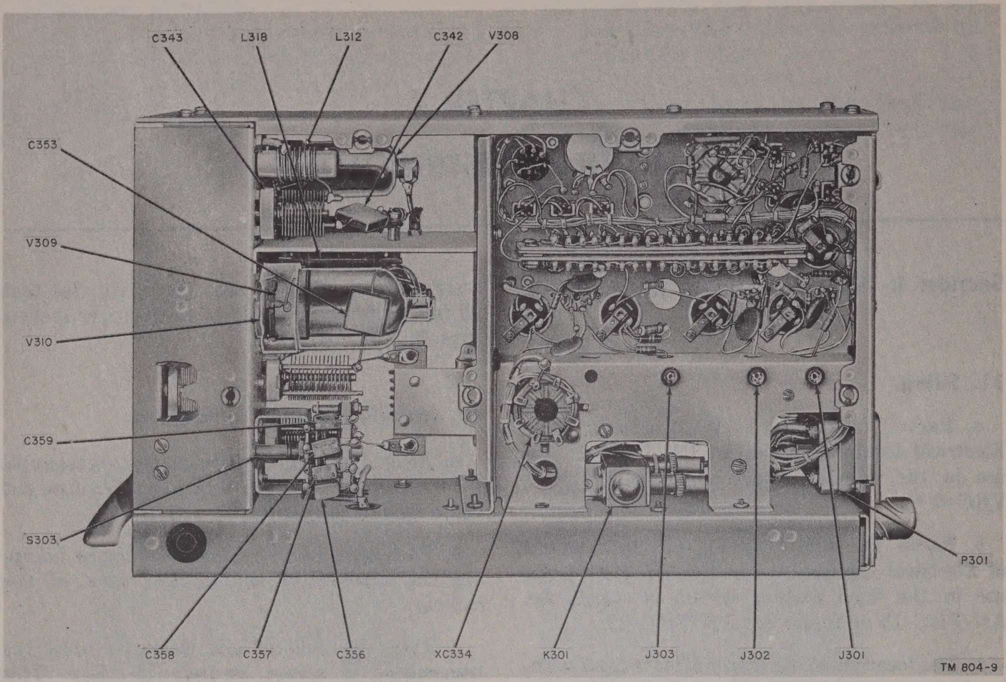


Figure 5. Radio Transmitters T–208/U and T–417/GR, right side.

Section II. CONTROLS AND INSTRUMENTS

15. Controls and Their Uses

Haphazard operation or improper setting of the controls can cause damage to the transmitter. For this reason, it is important to know the function of every control. Adjustment of all controls, in the proper order, is discussed in paragraphs 18 and 19.

16. Radio Transmitters T-208/U and T-417/GR Front Panel Controls

The following table lists the transmitter controls and indicates their functions:

Control	Function
TEST-OFF switch (S301)	In the TEST position, energizes a relay in an external power supply to provide power for the transmitter. In the OFF position, power can be applied to the transmitter by operation of the push-to-talk switch of Handset H-33/PT.
TUNE-OPERATE switch (S302)	In the TUNE position, reduces screen voltage applied to the driver and the power amplifier tubes. In the OPERATE position, applies full screen voltage.
DRIVER GRID TUNE control (C337)	Tunes the driver grid tank circuit to resonance.
DRIVER PLATE TUNE control (C343)	Tunes the driver-doubler plate tank circuit to resonance.

16. Radio Transmitters T-208/U and T-417/GR Front Panel Controls—(contd)

Control	Function
FINAL GRID TUNE control (C345)	Tunes the grid tank circuit of the power-amplifier tubes V309 and V310 to resonance.
FINAL PLATE TUNE control (C354)	Tunes the final tank circuit to resonance.
MIN-MAX COUPLING control (C355)	Provides fine control of coupling between the plate tank and the the filter network.
MIN-MAX COUPLING SW control (S303)	Coarse control of coupling adjustment in conjunction with C355.
DR GRID jack (J304)	Test point for checking grid voltage of the driver-doubler stage during tuning procedure.
FIN GRID jack (J305)	Test point for checking grid voltage of the power amplifier during tuning procedure.
PL CURRENT jacks (J306 and J307)	Test points for checking plate current of the power-amplifier stage during tuning procedure.

17. Radio Set Control C-847/U Front Panel Controls

(fig. 7)

Radio Set Control C–847/U is necessary for the operation of Radio Transmitter T–208/U with Radio Set AN/VRC–6(*). Controls and their functions are listed in the table below:

Controls and components	Function
VOLUME-OFF (S1501) switch	This switch controls the power to the radio set. It also adjusts the volume level of the handset earphone and speaker, by the insertion of an attenuator pad. Four volume levels are available.
SPKR ON-OFF (S1502) switch	In the ON position this switch connects the speaker. In the OFF position, the speaker is replaced by a 10-ohm resistor. The switch is spring loaded to remain in the ON position.
POWER indicator (I1501)	This pilot lamp glows whenever the VOLUME switch is in any position but OFF. It indicates that power is applied to the receiver.
TRANSMIT indicator (I1502)	This pilot lamp glows when the push-to-talk switch on the handset is closed, indicating that the transmitter is in operation and the receiver is disabled.
SQUELCH-OFF control (R1509) and switch (S1504)	The receiver squelch circuit is disabled with the SQUELCH control in the OFF position. In other positions the control sets the *threshold* of squelch operation.
FREQ switch (S1503)	The FREQ switch selects either of two fixed transmitter frequencies. The selection is made by supplying one oscillator in the transmitter with filament power.
HANDSET connector (J1501)	This connector is located on the under side of the control. It provides a connection from the handset to the receiver and transmitter.
Speaker	The speaker enables the operator to hear incoming signals without having to hold the handset to his ear. This feature is necessary while the vehicle is in motion or when more than one person desires to listen.

Section III. PRELIMINARY ADJUSTMENTS AND TUNING

18. Preliminary Adjustment of Radio Transmitters T-208/U and T-417/GR

Note. The following procedures for adjusting and tuning the transmitter must be performed by second echelon maintenance personnel.

To operate the transmitter, determine the operating frequency and tune the transmitter to that frequency. The following steps precede tuning:

a. Release the transmitter from the cabinet by turning the hold-in lock counterclockwise. The transmitter then may be pulled out by using the handle located on the front panel.

b. Remove the right and left side dust covers from the transmitter and check to see that all tubes are in place (figs. 3 and 6).

c. A patch cord (fig. 11) is required to complete the system connections when the transmitter is removed from the cabinet. This cord is described in paragraph 29. Connect the patch cord from jack J801 in Electrical Equipment Cabinet CY–938/VRC to plug P301 at the rear of the transmitter.

d. Connect the transmitting antenna to antenna plug P801 on Electrical Equipment Cabinet CY–938/VRC.

e. Determine the correct crystal frequency. The two preset operating frequencies of the transmitter may not differ by more than 250 kc and must fall in the operating range of the same final tank coil. After selecting two operating frequencies which meet this requirement, choose the correct crystal frequency by means of the following formula:

$$\text{Crystal frequency} = \frac{\text{operating frequency.}}{16}$$

Example:

F_1 = desired operating frequency = 30 mc

F_2 = alternative operating frequency = 30 ± .25 mc = 29.75 or 30.25 mc

F_c = crystal fundamental frequency

$$F_c = \frac{F_1}{16} = \frac{30{,}000 \text{ kc}}{16} = 1{,}875.000 \text{ kc}$$

$$F_c = \frac{F_2}{16} = \frac{29{,}750 \text{ kc}}{16} = 1{,}859.375 \text{ kc.}$$

To maintain accuracy of the operating frequency, carry out division to three places to the right of the decimal point. The example used the maximum allowable frequency difference between the two operating frequencies. Actually, more efficient transmitter operation is obtained when the two frequencies chosen are closer together. See paragraph 22.

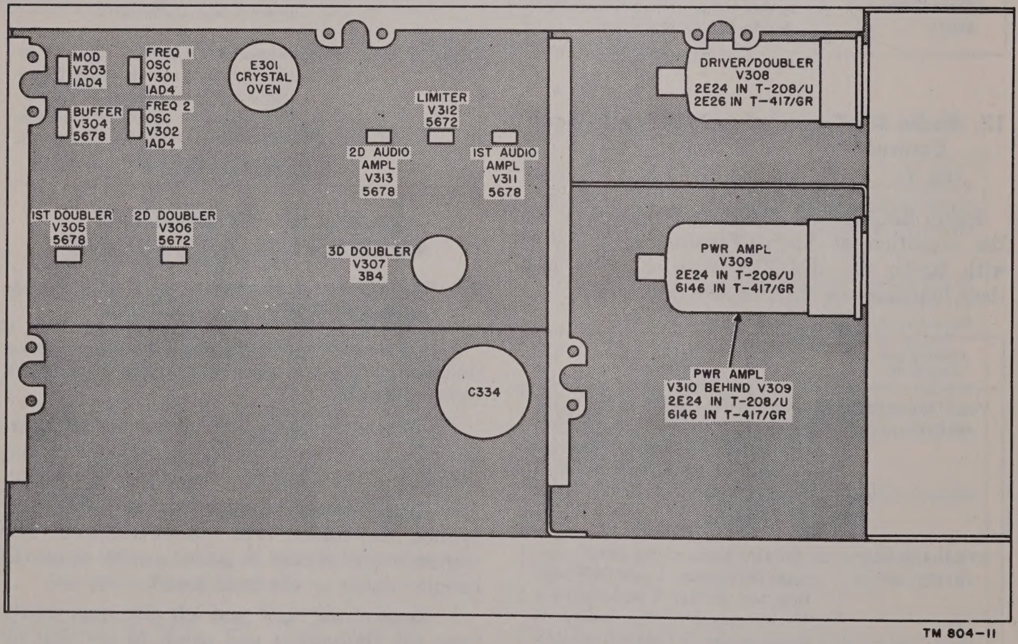

MOD
V303
1AD4
FREQ 1
OSC
V301
1AD4
E301
CRYSTAL
OVEN
BUFFER
V304
5678
FREQ 2
OSC
V302
1AD4
LIMITER
V312
5672
2D AUDIO
AMPL
V313
5678
IST AUDIO
AMPL
V311
5678
IST DOUBLER
V305
5678
2D DOUBLER
V306
5672
3D DOUBLER
V307
3B4
C334
DRIVER/DOUBLER
V308
2E24 IN T-208/U
2E26 IN T-417/GR
PWR AMPL
V309
2E24 IN T-208/U
6146 IN T-417/GR
PWR AMPL
V310 BEHIND V309
2E24 IN T-208/U
6146 IN T-417/GR
TM 804-11

Figure 6. Radio Transmitters T–208/U and T–417/GR, tube locations.

f. Install the required crystals by first unplugging the entire crystal oven assembly E301 (fig. 8). Then remove the three screws securing the cover of the crystal oven to the socket, unplug the heater and thermostat element from the socket, and insert the crystals into the socket base. Reassemble in the reverse order.

g. Install the proper coil (L316, L317 or L319) in the final tank circuit. The 9-turn coil (L319) is used for the 25 to 32-mc band; the 6-turn coil (L317) is used for the 32 to 40-mc band; the 5-turn coil (L316) is used for the 40 to 50-mc band. The coil for the particular band used is fastened to the terminal board by two 6-32 screws. The other coils are kept on the left side dust cover.

h. Install the proper jumper connections for the antenna filter. Solder the jumpers to the terminal strip connectors (fig. 9) according to the following table:

Freq (mc)	Antenna filter connections		
	Strap		
25-32	2-3	4-6	9-8
	2-1	4-5	9-10
32-40	2-3	4-6	9-8
40-50	2-1	4-5	9-10

i. Turn the VOLUME-OFF switch on Radio Set Control C–847/U clockwise to apply power to the heating element of the crystal oven. At least 15 minutes heating time should be allowed before switching the TEST-OFF switch to the TEST position in order to attain a stable crystal temperature.

j. Turn frequency selector switch (FREQ) on Radio Set Control C–847/U to either FREQ 1 or FREQ 2 position.

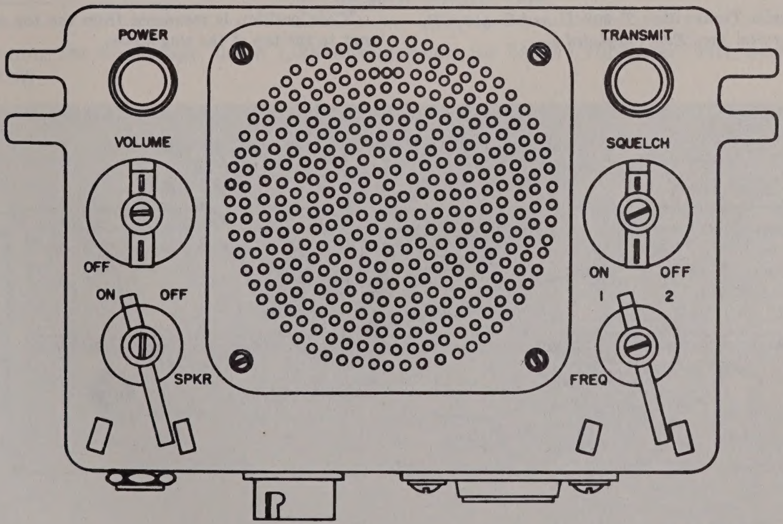


Figure 7. Radio Set Control C–847/U, front panel.

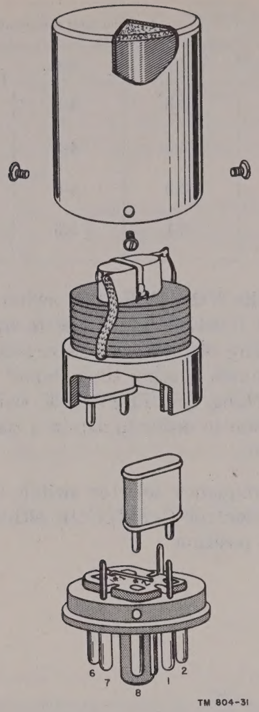


Figure 8. Radio Transmitters T–208/U and T–417/GR, crystal oven E301, exploded view.

19. Tuning Radio Transmitter T-208/U or T-417/GR

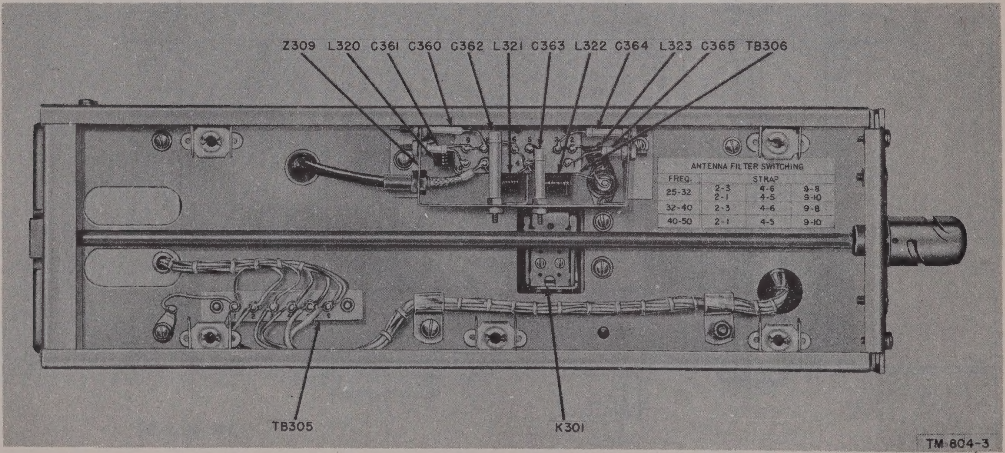
To tune the transmitter, two meters are required. One is a vtvm (vacuum tube voltmeter, Electronic Multimeter TS–505/U or equal) for measuring grid voltage, and the other a voltmeter having a sensitivity of at least 1,000 ohms per volt (Multimeter TS–297/U) for determining plate current. Refer to figure 10 for test and alinement points.

a. Set tuning adjusting screws of Z301, Z302, Z303, Z304, and Z305 to the approximate operating frequency as indicated by the following chart.

FREQUENCY—POSITION TABLE

Core position in 16ths of an inch*	Final output in mc	Core position in 16ths of an inch*	Final output in mc
2	25.0	7	35.0
3	26.5	8	37.5
4	28.0	9	40.0
5	30.0	10	45.0
6	32.5	11	48.0
		12	50.0

*Core position is measured from the top of the tension unit to the top of the slug screw.



ANTENNA FILTER SWITCHING

FREQ.	STRAP		
25-32	2-3 2-1	4-6 4-5	9-8 9-10
32-40	2-3	4-6	9-8
40-50	2-1	4-5	9-10

Figure 9. Radio Transmitters T–208/U and T–417/GR, bottom view.

b. Set the tuning controls on the front panel to the approximate frequency.

c. Set the COUP SW S303 to MIN and COUPLING capacitor C355 to MIN coupling.

d. Place the TUNE-OPERATE switch S302 to TUNE position.

e. Place the TEST-OFF switch S301 to OFF position.

f. Turn VOLUME-OFF control on the control unit clockwise to turn on control power.

g. Place TEST-OFF switch S301 to TEST position.

h. After the steps in the preceding subparagraphs have been made, use the following charts and the vacuum tube voltmeter to tune the transmitter properly.

Note. The maximum reading should be within 20 percent of the listed normal reading. If it cannot be obtained refer to the trouble-shooting section of this instruction book.

Tuning the multiplier and driver stages

Test point	Normal reading (volts)		Adjustment
	T-208/U	T-417/GR	
J301	−20	−21	Adjust the tuning screw slug on Z301 for maximum voltmeter reading.
J302	−25	−30	Adjust the tuning screw slug on Z302 for maximum voltmeter reading.
J303	−24	−27	Adjust the tuning slug screw on Z303 then on Z304 for maximum reading. Repeat the above procedure twice.
DR GRID (J304)	−65	−63	Adjust DRIVER GRID TUNE C337, then the tuning slug screw on Z305 for maximum voltmeter reading. Repeat the above procedure twice.
FIN GRID (J305)	−31	−40	Adjust FINAL GRID TUNE capacitor C345, then DRIVER PLATE TUNE capacitor C343 for maximum voltmeter deflection. Repeat the above procedure twice.

i. For tuning the final stage, use a 1,000-ohm-per-volt (or better) voltmeter, with leads inserted in J306 and J307.

Tuning the final stage

Voltmeter selector switch	Test point		Normal reading (volts)		Adjustment
	From	To	T-208/U	T-417/GR	
0–5 v dc	PL CURRENT (J306)	PL CURRENT (J307+)	1.3	2	Adjust C354 for minimum voltmeter reading. With S303 at MIN adjust COUPLING capacitor C355 until a maximum reading is obtained. Readjust C354 for minimum and again C355 for maximum. If it cannot be obtained, or if reading is too low, turn S303 to a position one above MIN and repeat above procedure. Continue turning S303 towards MAX until the proper reading is obtained. The last adjustment always is capacitor C354 for a minimum.

j. Turn the TEST-OFF switch to the OFF position.

k. Disconnect the meters, reassemble the dust covers, and install the transmitter in the cabinet.

Section IV. OPERATION UNDER USUAL CONDITIONS

20. Preliminary Starting Procedure for Radio Transmitters T-208/U and T-417/GR

a. Set the TEST-OFF switch to the OFF position.

b. Set the TUNE-OPERATE switch to the OPERATE position.

c. Turn the SQUELCH-OFF switch on Radio Set Control C–847/U to the SQUELCH position.

d. Turn the VOLUME-OFF switch on Radio Set Control C–847/U in a clockwise direction toward the VOLUME position. Power will be applied to the crystal heater of the transmitter.

e. Select the desired operating frequency by turning the FREQ selector switch on Radio Set Control C–847/U to FREQ 1 or FREQ 2. Filament power then will be applied to the correct oscillator tube of the transmitter as soon as the push-to-talk switch on the handset is closed.

21. Starting Procedure for Radio Transmitters T-208/U and T-417/GR

Note. If, during the starting procedure, an abnormal result is obtained, refer to the equipment performance checklist, paragraph 41.

a. Press the push-to-talk switch of Handset H–33/PT. The TRANSMIT indicator lamp on the control unit should light.

b. Voice transmission now can be accomplished. Releasing the push-to-talk switch turns off the transmitter and enables the receiver to operate.

22. Frequency Changing

Changing to the alternate operating frequency is accomplished by turning the FREQ selector switch on Radio Set Control C–847/U to the alternate position. This may be done at any time and does not necessitate retuning the transmitter. The initial tuning procedure alines the transmitter for operation under the control of one specific crystal. The restriction that the maximum allowable difference between two operating frequencies be held within 250 kc, permits changing to the alternate crystal without any serious detuning of the transmitter.

23. Stopping Procedure for Radio Transmitters T-208/U and T-417/GR

a. Releasing the push-to-talk switch of Handset H–33/PT removes all power from the transmitter, with the exception of the crystal oven heating element.

b. Turning the VOLUME-OFF switch on Radio Set Control C–847/U to the OFF position completes the shut-down of the equipment by removing power from the crystal oven heating element.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

24. General

The operation of the transmitter may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedure for minimizing the effects of unusual operating conditions.

25. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather will affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep tube filaments lighted constantly, but do not overtax the power supply. Refer to note 5 of figure 32 for a jumper connection which will maintain a constant reduced voltage on the tube filaments.

c. When the equipment has been exposed to the cold and is brought into a warm area, it will sweat until it reaches the ambient temperature. Dry it thoroughly. Remove any coating of frost which may form.

26. Operation in Tropical Climates

a. In tropical climates, the equipment will be subject to moisture conditions more acute than normal. High relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. Make frequent checks for moisture. Dry the equipment thoroughly.

b. The fungiproofing on all items must remain unbroken.

27. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand, or dust and dirt, which may enter the moving parts of the transmitter controls. Make frequent preventive maintenance checks.

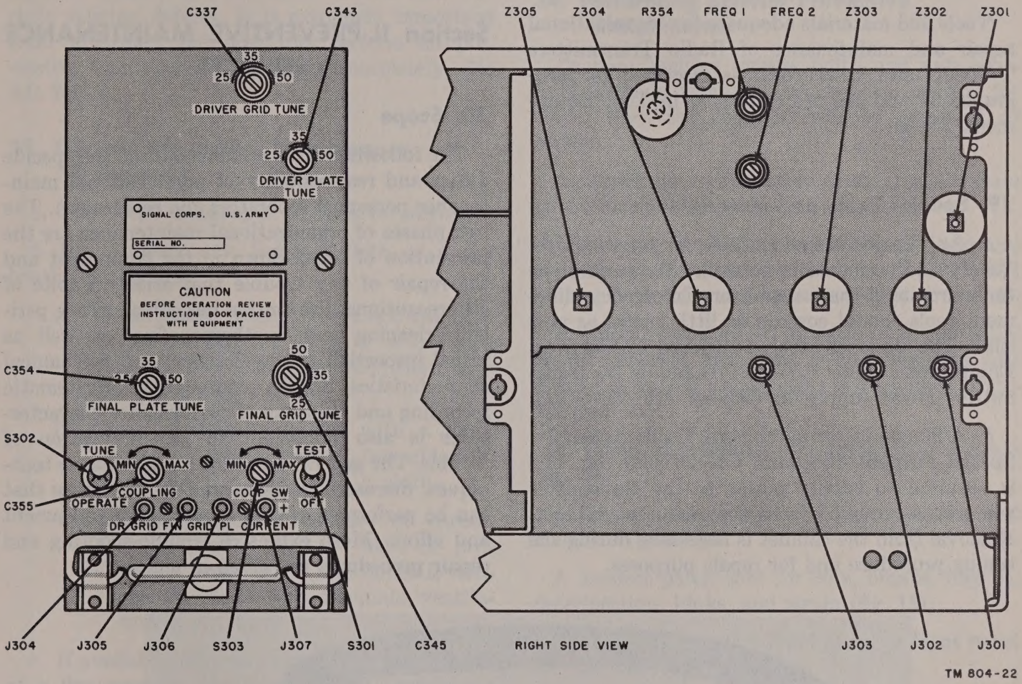

C337
C343
Z305
Z304
R354
FREQ 1
FREQ 2
Z303
Z302
Z301
35
25
50
DRIVER GRID TUNE
35
25
50
DRIVER PLATE TUNE
SIGNAL CORPS. U.S. ARMY
SERIAL NO.
CAUTION
BEFORE OPERATION REVIEW INSTRUCTION BOOK PACKED WITH EQUIPMENT
C354
35
25
50
FINAL PLATE TUNE
50
35
25
FINAL GRID TUNE
S302
TUNE
MIN
MAX
MIN
MAX
TEST
COUPLING
COUP SW
C355
OPERATE
OFF
+
DR GRID
FIN GRID
PL CURRENT
J304
J305
J306
S303
J307
S301
C345
RIGHT SIDE VIEW
J303
J302
J301
TM 804-22

Figure 10. Radio Transmitters T–208/U and T–417/GR, test points and alinement locations.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

28. Tools and Materials

Tools and materials adequate for organizational repair and maintenance of Radio Transmitters T–208/U and T–417/GR, as discussed in paragraphs 34 and 35, are contained in Tool Equipment TE–41.

29. Special Tools and Materials

a. An alinement tool suitable for h-f (high-frequency) adjustments is necessary for tuning the tank circuits of the transmitter. Emergency alinement tools should contain as little metal as possible. The alinement tool is attached to Electrical Equipment Cabinet CY–1221/G and on the transmitter power supply in Cabinet CY–938/VRC.

b. A 20-conductor patch cord, Cable Assembly, Special Purpose, Electrical CX–2371/U (fig. 11), is required to supply power to the transmitter when it is removed from the radio set cabinet. Removal from the cabinet is necessary during the tuning procedure and for repair purposes.

c. Five Allen wrenches are attached to the right side dust cover with spring binding posts. They are used for the variable capacitor shaft coupling screws.

Section II. PREVENTIVE MAINTENANCE SERVICES

30. Scope

The following three sections outline the specific duties and responsibility of organizational maintenance personnel (operators and repairmen). The two phases of organizational maintenance are the prevention of break-down in the equipment and the repair of any trouble that arises in spite of all precautions. Preventive measures include periodic cleaning and weatherproofing, as well as visual inspection of the electrical and mechanical characteristics of the components. Systematic recording and studying of performance characteristics is also important in the prevention of trouble. The general preventive maintenance techniques, discussed in paragraph 32, are those that can be performed with a minimum of equipment and effort. More extensive trouble-shooting and repair procedures are given in chapter 5.

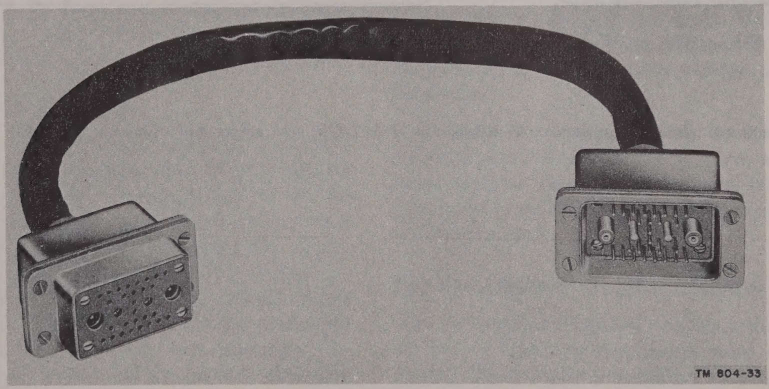


Figure 11. Cable Assembly, Special Purpose, Electrical CX-2371/U.

31. Definition of Preventive Maintenance

The best maintenance work is preventive in nature; potential failures are spotted and corrected before they have a chance to develop. This is accomplished by a definite sequence of operations performed on the equipment, and by the systematic recording and studying of all performance, test, and servicing data. Preventive maintenance differs from trouble shooting and repair in that the former prevents breakdowns and subsequent repairs, and the latter locates and corrects existing defects. It is extremely important that repairmen and operators perform all preventive maintenance operations completely. See AR 750–5.

32. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

> **Caution:** Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

33. Use of Preventive Maintenance Forms
(figs. 12 and 13)

a. The decision as to which items on DA AGO Forms 11–238 and 11–239 are applicable to this equipment is a decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 12 and 13 are partially or totally applicable to the transmitting equipment. References in the ITEM block refer to paragraphs in the text which contain additional maintenance information.

34. Performing Exterior Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Check for completeness of equipment: spare parts, instruction book, and accessories.

b. Remove dirt and moisture from all jacks and controls on the front panel. Inspect plug P301 on the back of the transmitter (figs. 1 and 4).

c. Check for normal operation. If abnormal results occur at any point in the operating procedure, refer to the equipment performance checklist (par. 41).

d. Clean and tighten the transmitter cabinet (fig. 1).

e. Inspect metal surfaces for corrosion and moisture (par. 37).

f. Inspect patch cord for cuts, breaks, fraying, deterioration, kinks, and strain (fig. 11).

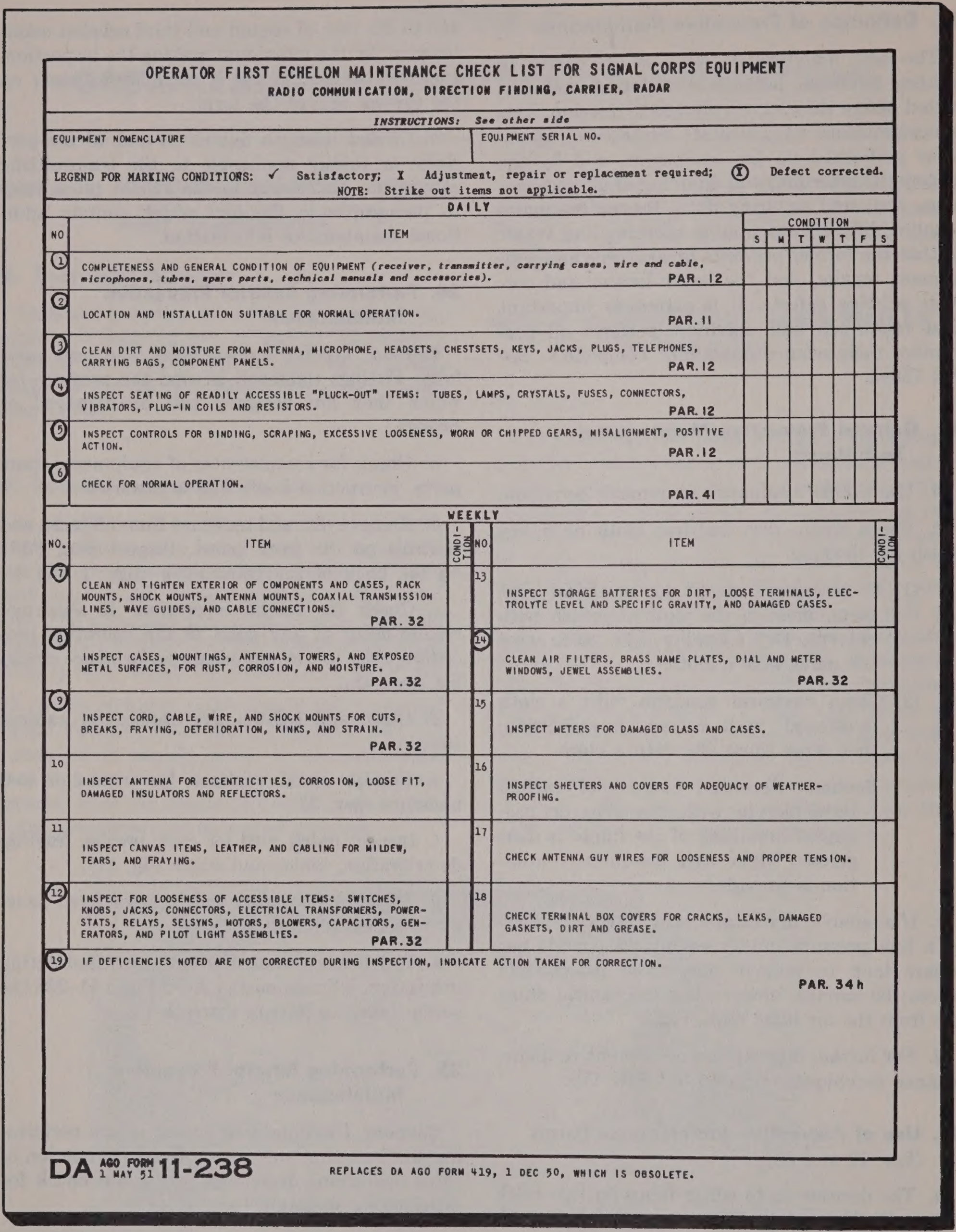
g. Inspect all switches and jacks on front panel for looseness (fig. 4).

h. If deficiencies noted are not corrected during inspection, indicate on DA AGO Form 11–238 the action taken to initiate correction.

35. Performing Interior Preventive Maintenance

Caution: Disconnect all power before performing the following operations. Upon completion of these operations, reconnect power and check for satisfactory operation (par. 41).

a. Inspect seating of plug-in capacitor C334 and the crystal oven unit (fig. 3). Check tightness of coaxial connectors at the antenna relay.



OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: *See other side*

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.

NOTE: Strike out items not applicable.

DAILY

NO	ITEM	CONDITION						
		S	M	T	W	T	F	S
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 12							
②	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 11							
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 12							
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 12							
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 12							
⑥	CHECK FOR NORMAL OPERATION. PAR. 41							

WEEKLY

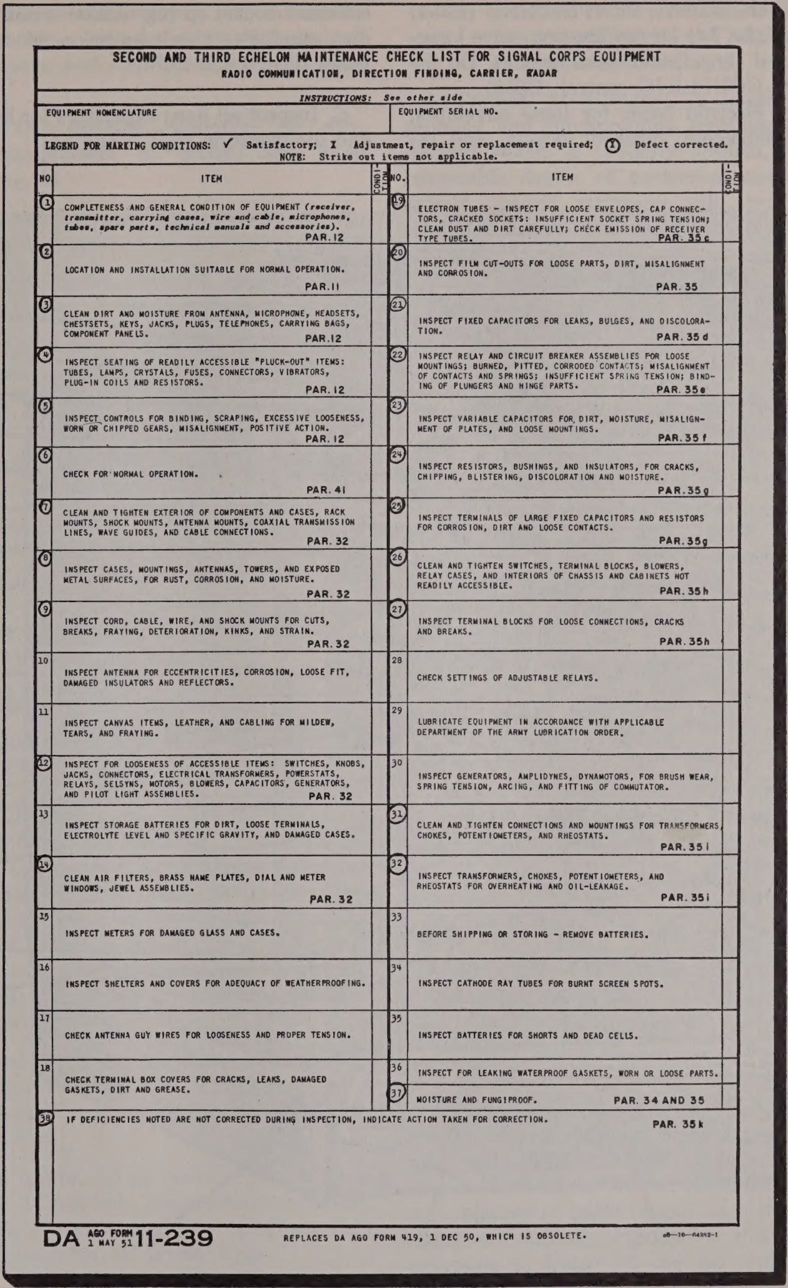
NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 32		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 32		⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 32	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 32		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 32		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

⑲ IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 34h

DA AGO FORM 1 MAY 51 **11-238** REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 804-28

Figure 12. DA AGO Form 11-238.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS:* *See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; Ⓘ Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* **PAR. 12**		⑲	ELECTRON TUBES – INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. **PAR. 35 c**	
②	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. **PAR. 11**		⑳	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION. **PAR. 35**	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. **PAR. 12**		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. **PAR. 35 d**	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. **PAR. 12**		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. **PAR. 35 e**	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. **PAR. 12**		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. **PAR. 35 f**	
⑥	CHECK FOR NORMAL OPERATION. **PAR. 41**		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. **PAR. 35 g**	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. **PAR. 32**		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. **PAR. 35 g**	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. **PAR. 32**		㉖	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. **PAR. 35 h**	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. **PAR. 32**		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. **PAR. 35 h**	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. **PAR. 32**		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. **PAR. 35 i**	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. **PAR. 32**		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. **PAR. 35 i**	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.		33	BEFORE SHIPPING OR STORING – REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			㊲	MOISTURE AND FUNGIPROOF. **PAR. 34 AND 35**	
㊳	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. **PAR. 35 k**				

DA AGO FORM 1 MAY 51 **11-239** REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. o8—16—64392-1

Figure 13. DA AGO Form 11-239.

b. Inspect the FINAL PLATE TUNE (C354) control shaft (fig. 14) for binding, excessive looseness, damaged thread, and misalinement. Do the same for the COUPLING control (C355).

c. Inspect electron tubes for loose envelopes, loose cap connectors, cracked sockets, and insufficient socket spring tension; remove dust and dirt carefully; check emission of receiver-type tubes (figs. 3 and 6).

d. Inspect all fixed capacitors for leaks, bulges, and discoloration (figs. 9 and 14).

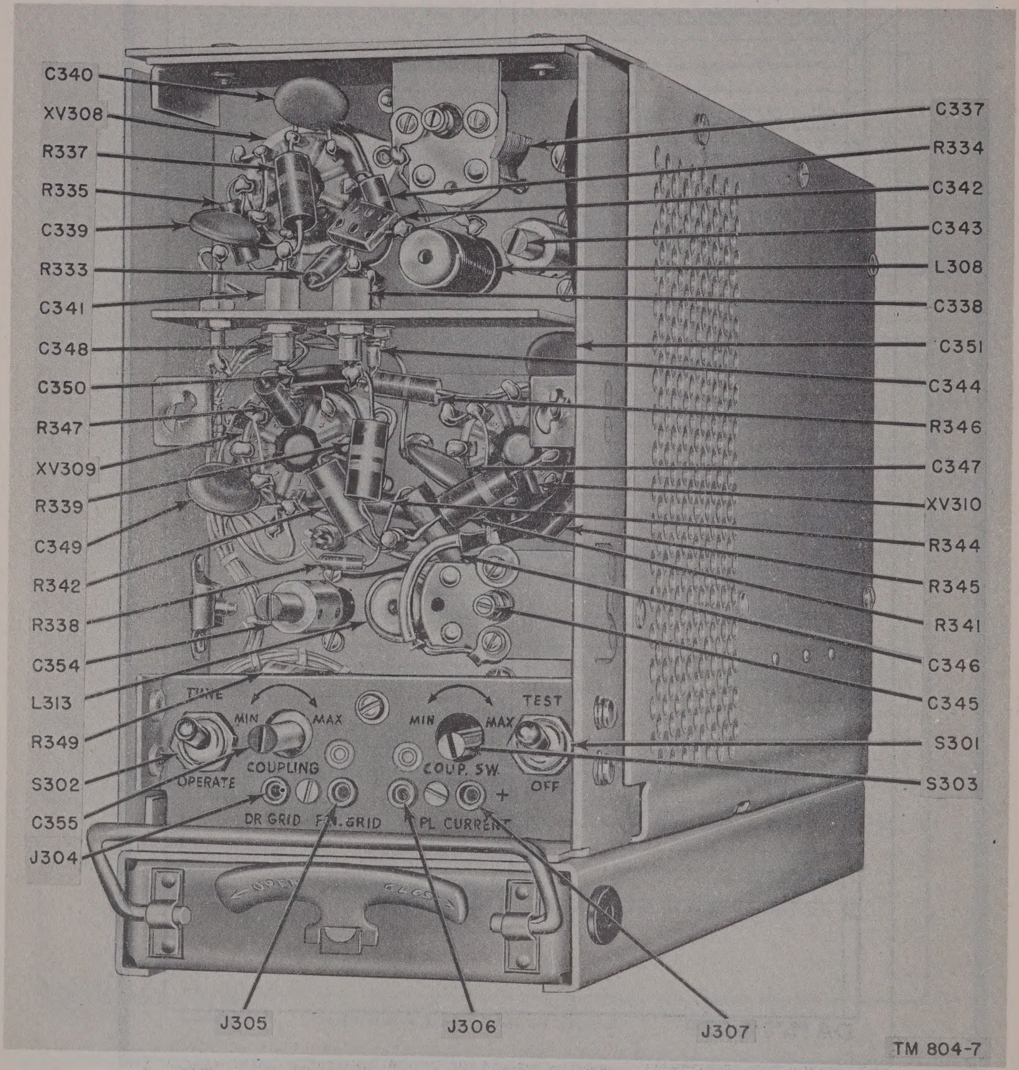

C340
XV308
R337
R335
C339
R333
C341
C348
C350
R347
XV309
R339
C349
R342
R338
C354
L313
R349
S302
C355
J304
C337
R334
C342
C343
L308
C338
C351
C344
R346
C347
XV310
R344
R345
R341
C346
C345
S301
S303
TUNE
MIN
MAX
COUPLING
OPERATE
DR GRID
FN. GRID
MIN
MAX
COUP. SW.
TEST
OFF
PL CURRENT
+
J305
J306
J307
TM 804-7

Figure 14. Radio Transmitters T–208/U and T–417/GR, front view, front panel removed.

e. Inspect the antenna relay in the transmitter for loose mounting, corroded contacts, misalinement of contacts, and insufficient spring tension (fig. 5).

f. Inspect the variable capacitors for dirt, moisture, misalinement of plates, and loose mountings (fig. 5).

g. Inspect resistors and insulators for cracks, chips, blisters, discoloration, and moisture (fig. 14).

h. Clean and tighten switches, antenna relay mount, and interior components (fig. 3).

i. Clean and tighten connections and mounting of the power-amplifier tank coil. Check the mounting of transformer T301 and potentiometer R354 (fig. 3).

j. Check moistureproofing and fungiproofing to see that it is unbroken (par. 37).

k. If deficiencies noted are not corrected during inspection, indicate on DA AGO Form 11–239 the action taken to initiate correction.

Section III. LUBRICATION AND WEATHERPROOFING

36. Lubrication

Radio Transmitters T–208/U and T–417/GR require no lubrication.

37. Weatherproofing

a. *General*. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials. Some of the problems encountered are:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

(3) Break-down of insulation on hook-up wires and cables. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flash-overs.

b. *Tropical Maintenance*. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and excessive moisture. This treatment is explained in TB SIG 13 and TB SIG 72.

c. *Winter Maintenance*. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. *Desert Maintenance*. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

38. Rustproofing and Painting

a. The protective covers and front panel of the transmitter are constructed of an aluminum alloy, with an iridite finish. Rust conditions normally will not be encountered. Corrosion of any nature should be removed by cleaning with solvent (SD) and crocus cloth, or #0000 sandpaper if necessary.

Caution: Do not use steel wool. Minute particles frequently enter the cabinet and cause harmful internal shorting or grounding of circuits.

b. Should painting be necessary, refer to TM 9–2851 for instructions.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

39. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is limited necessarily in scope by the tools, test equipment, and replaceable parts issued, and by the existing situation. Accordingly, trouble shooting by the operators is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The following paragraphs in this section help in determining which stage is at fault and in localizing the fault in that stage to the defective item such as a tube or capacitor.

40. Visual Inspection

a. When Radio Transmitter T–208/U or T–417/GR fails to operate properly, a visual examination of the following items ordinarily will determine the faulty part:

(1) Wiring for loose or poorly soldered connections, frayed or burned insulation, or stretched leads.

(2) Terminal boards for broken lugs and signs of arcing.

(3) Split, cracked or broken crystal holder.

(4) Resistors for blistering or discoloration caused by overheating.

(5) Worn, broken, or disconnected cords or plugs.

(6) Faulty relay contacts.

(7) Wires broken because of excessive vibration.

(8) Defective tubes.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the system. If possible, obtain information from the operator of the equipment regarding performance at the time trouble appeared.

c. If this inspection does not yield results, use the same procedure on all other components of the system, especially the cabinet, the power supply, and the antenna.

41. Trouble Shooting by Use of Equipment Performance Checklist

a. General. The equipment performance checklist will help the operator to locate trouble in the transmitter. The checklist gives the item to be checked, the conditions under which the item is checked, the normal indications, and the corrective measures that can be taken. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. The information in this column indicates the components to be checked and the settings of various switches and controls.

c. Normal Indications. The normal indications listed indicate what action should occur in the transmitter. A TRANSMIT indicator lamp on Radio Set Control C–847/U shows the operator that the transmitter is on.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble-shooting is necessary. Reference is made to the item in the trouble-shooting chart (par. 62) which covers the fault.

e. Equipment Performance Checklist.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Tubes	All tubes are in place (fig. 6).		
	2	Crystal	Proper crystal installed in crystal oven (par. 18*e*).		
	3	Radio Set AN/VRC–6(*).	All components properly connected (fig. 2).		
	4	Tuning controls of transmitter.	Pretuned to desired operating frequency (pars. 18 and 19).		

e. Equipment Performance Checklist (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	5	TEST-OFF switch.....	Turned to the OFF position.		
	6	TUNE-OPERATE switch.	Turned to the OPERATE position.		
	7	SQUELCH switch of Radio Set Control C–847/U.	Turned to the SQUELCH position.		
	8	VOLUME-OFF switch of Radio Set Control C–847/U.	Turned toward the VOLUME position.	Power is applied to crystal oven of the transmitter.	Check fuses in the cabinet and the power supply. See item 1 of paragraph 62.
	9	FREQ selector switch of Radio Set Control C–847/U.	Turned to FREQ 1 or FREQ 2, depending on choice of operating frequency.	Power is applied to an oscillator tube filament in the transmitter.	Check fuses in the cabinet and the power supply. See item 1 of paragraph 62.

e. Equipment Performance Checklist (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIP. PERF.	10	Handset H–33/PT.....	Switch is pressed for push-to-talk operation.	TRANSMIT indicator lamp on Radio Set Control C–847/U lights. Power is applied to the transmitter and the system is set up for voice transmission.	Check fuses in the cabinet and the power supply. See items 5 and 6 of paragraph 62.

e. Equipment Performance Checklist (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	11	Handset H–33/PT.....	Push-to-talk switch is released.	TRANSMIT indicator lamp of Radio Set Control C–847/U goes out. Main power circuit to transmitter is de-energized.	
	12	VOLUME-OFF switch of Radio Set Control C–847/U.	Turned to the OFF position.	Filament power to the oscillator tube and power to the crystal heater is removed. Entire system is shut down.	

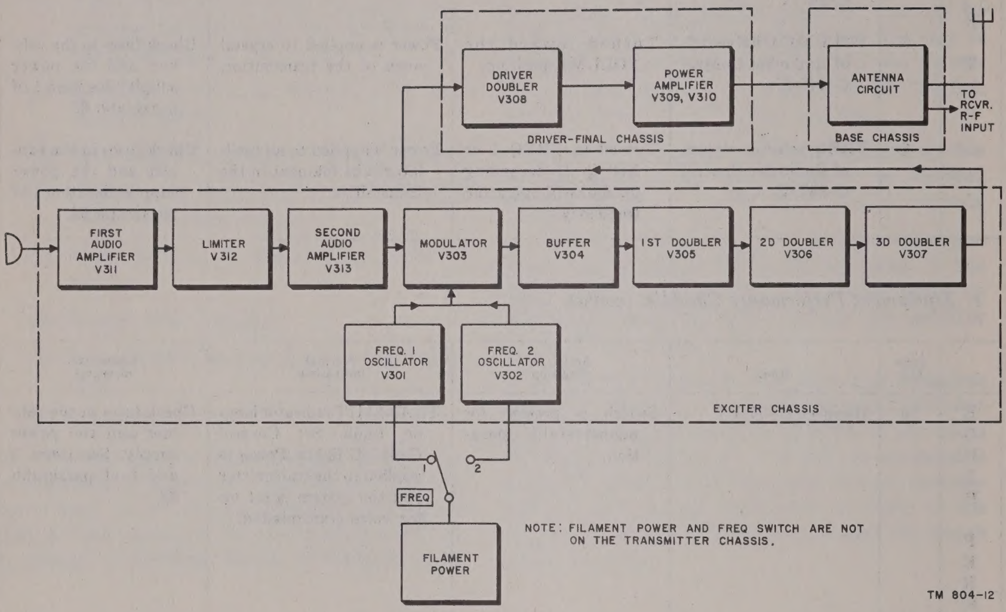

DRIVER DOUBLER V308
POWER AMPLIFIER V309, V310
DRIVER-FINAL CHASSIS
ANTENNA CIRCUIT
BASE CHASSIS
TO RCVR. R-F INPUT
FIRST AUDIO AMPLIFIER V311
LIMITER V312
SECOND AUDIO AMPLIFIER V313
MODULATOR V303
BUFFER V304
1ST DOUBLER V305
2D DOUBLER V306
3D DOUBLER V307
FREQ. 1 OSCILLATOR V301
FREQ. 2 OSCILLATOR V302
EXCITER CHASSIS
1
2
FREQ
FILAMENT POWER
NOTE: FILAMENT POWER AND FREQ SWITCH ARE NOT ON THE TRANSMITTER CHASSIS.
TM 804-12

Figure 15. Radio Transmitters T–208/U and T–417/GR, block diagram.

CHAPTER 4

THEORY OF OPERATION

42. General

This chapter contains the detailed theory of operation for Radio Transmitters T–208/U and T–417/GR, with particular emphasis placed upon Radio Transmitter T–208/U as operated in the mobile system of Radio Set AN/VRC–6(*). Because of the numerous interconnections between units of this system, all control circuits for application of power to the transmitter have been traced to their origin. Power supply connections apply to the 6-volt battery-operated Dynamotor-Power Supply DY–100/U.

43. Block Diagram

The system block diagram (fig. 2) shows the application of the transmitter within the system. For more detailed over-all circuit information on the transmitter, refer to figure 15. The signal paths through the transmitter are described briefly in the following subparagraphs.

a. Radio Transmitter T–208/U.

(1) *R-f oscillator.* Two crystal-controlled oscillator stages, V301 and V302, are used to allow a quick change between two predetermined operating frequencies. The oscillator to be used is selected by a switch on Radio Set Control C–847/U (external to the transmitter) which allows filament voltage to be applied to one oscillator and removes it from the other. A crystal frequency of 1.5625 to 3.125 mc, depending on the crystal used, is fed to the control grid of tube V303.

(2) *Phase modulator.* An audio signal from tube V313 (subpar. (11), p. 26) also is applied to the control grid of phase modulator tube V303 (5678). With r-f and audio voltages being applied to the grid, a relative phase shift takes place between the signal components at the plate. The output of this stage is phase-modulated r-f at the crystal frequency, with a deviation of 937.5 cycles for 100 percent modulation.

(3) *Buffer.* Buffer stage, V304 (5678) furnishes a constant load for the modulator and acts as an isolating stage. Its r-f output is at the same frequency as the oscillator with a deviation of 937.5 cycles.

(4) *First doubler.* First doubler tube V305 (5678) has a single tuned plate circuit operating at twice the crystal frequency, with a deviation of 1,875 cycles. This output is applied to the grid of second doubler tube V306.

(5) *Second doubler.* Second doubler tube V306 (5672) has a single tuned plate circuit operating at four times the crystal frequency, with a deviation of 3,750 cycles. This output is applied to the grid of third doubler tube V307.

(6) *Third doubler.* Third doubler tube V307 (3B4) has a single tuned plate circuit operating at eight times the crystal frequency, with a deviation of 7,500 cycles. This output is applied to the grid of driver/doubler tube V308.

(7) *Driver/doubler.* Driver/doubler stage V308 (2E24) has its plate circuit tuned to 16 times the crystal frequency, with a deviation of 15,000 cycles (15 kc). This stage is inductively coupled to the grid circuits of power-amplifier tubes V309 and V310.

(8) *Power amplifiers.* The power-amplifier stages consist of two tubes, V309 and V310, both type 2E24 tubes, operated in parallel. The pi type plate tank is tuned to resonance by variable capacitor C354 (FINAL PLATE TUNE). A

coarse adjustment of the antenna coupling is made by fixed capacitors, and a fine adjustment is accomplished by the variable capacitor. Power output from the final amplifiers passes through an antenna filter to attenuate undesired harmonics.

(9) *First audio amplifier.* Audio signals from the microphone of Handset H–33/PT, or signals from a radio receiver (retransmission), are applied through an impedance-matching transformer and a high-pass filter to the control grid of first audio amplifier tube V311 (5678). The output of this stage is coupled to the grid of limiter tube V312.

(10) *Limiter.* Limiter tube V312 (5672) serves to limit the amplitude of the audio signal. The output of this tube is passed through a low-pass filter network and is applied to the grid of the second audio amplifier.

(11) *Second audio amplifier.* Second audio amplifier tube V313 is a type 5678 tube. The audio level of the amplified output of this tube is adjusted by the DEVIATION LEVEL control and is supplied to the grid of phase modulator tube V303 (subpar. (2), p. 25).

b. Radio Transmitter T–417/GR. The block diagram for Radio Transmitter T–417/GR follows the same sequence as Radio Transmitter T–208/U. Circuit components are identical in both models up to the driver/doubler stage. From this stage on, other tube types are used to increase the power output of the transmitter. Note the following major changes:

(1) *Driver/doubler.* A type 2E26 tube (V308) is used, which has its plate circuit tuned to 16 times the crystal frequency with a deviation of 15 kc. This stage is inductively coupled to the grid circuits of power-amplifier tubes V309 and V310.

(2) *Power amplifiers.* The power-amplifier stages consist of two type 6146 tubes. The tubes are operated in parallel, as in Radio Transmitter T–208/U; however, the greater efficiency and power handling capability of the type 6146 tubes increases the usable output power.

44. Crystal Oscillator

(fig. 16)

a. Two crystal controlled oscillator tubes, V301 and V302, are used to allow a quick change between two predetermined operating frequencies. Selection of the oscillator to be used is made at Radio Set Control C–847/U, external to the transmitter.

b. When the radio set control VOLUME-OFF switch is turned clockwise toward the VOLUME position, 6 volts d-c is applied to the heating element of crystal oven E301. An oven thermostat maintains a uniform temperature for the two inclosed crystals (Y301 and Y302), thus eliminating any deviation in the crystal operating frequency due to temperature change. The two crystals are 1/16 of the transmitter output frequency and do not differ from each other by more than 15.625 kc. The subsequent frequency multiplication of 16 times is therefore held within the allowable 250-kc difference.

c. When the Radio Set Control C–847/U FREQ selector switch is turned to the FREQ 2 position and the switch of Handset H–33/PT is pressed for push-to-talk operation, 1.3 volts d-c is applied to the heater-cathode of FREQ 2 oscillator tube V302. Plate and screen voltages are applied simultaneously and conduction takes place.

d. A crystal is connected between the screen grid and the control grid of tube V302, and acts as a tuned circuit at the operating frequency of the crystal. An electrical strain thus is exerted on the crystal so that it vibrates mechanically at its resonant frequency and develops grid excitation voltage. Energy fed back is sufficient to make up for losses in the resonant circuit so that oscillations may continue.

e. As the grid excitation voltage swings the grid positive, grid current flows through grid leak resistor R301 and an operating bias is developed. This bias makes the control grid negative with respect to the cathode.

f. Capacitor C303 is variable and may be used to correct the oscillator frequency if the crystal is not oscillating exactly at the desired frequency (par. 18*e*).

g. The d-c B+ supply voltage (90 volts) is obtained from terminal 26 of plug P301 and is applied to the plate through voltage-dropping resistor R305 and coil L302. Additional voltage drop for correct screen potential is obtained by resistor R302. Capacitor C301 is used to provide additional feedback capacity from screen to control grid. Decoupling of the B+ supply is provided by capacitor C311.

h. The r-f oscillations in the screen-to-cathode circuit modulate the electron flow between the cathode and plate of the tube. R-f output voltage is developed across oscillator plate load inductance L302 and is coupled to the phase modulator stage control grid through capacitor C310.

i. Changing to FREQ 1 at the control unit switches filament voltage from tube V302 to tube V301. This action disables tube V302 (lack of filament power) and substitutes an oscillator of a different frequency into the circuit. This circuit is composed of FREQ 1 oscillator tube V301, together with associated components and circuits identical to those already described for FREQ 2 oscillator tube V302.

45. Phase Modulator

(fig. 16)

a. The output of the oscillator is impressed on the control grid of phase-modulator tube V303 through coupling capacitor C310. Because of the action of the tube, an output voltage appears at the plate which is approximately 180° out of phase with the input voltage. Oscillator output also is coupled, through C309 and L301, to the plate of tube V303. Two voltages, which are out of phase, are therefore present at the plate of tube V303.

b. The magnitudes of these two voltages are approximately equal. The bias determines the initial value of transconductance of the tube. During modulation, audio voltage input to the control grid of tube V303 varies the bias, which in turn varies the transconductance of the tube at an audio rate. This action changes the phase relationship between the two voltages at the plate of tube V303 and produces a resultant plate voltage which varies the phase in synchronism with the a-f (audio-frequency) modulating voltage.

c. The effect of the audio modulating voltage on the r-f voltage is illustrated in figure 17. The phase change depends on the amplitude of the modulating voltage. In the figure, as the modulating a-f voltage reaches its positive peak the phase displacement of the modulated r-f voltage is maximum (lagging). The phase displacement lessens as the audio voltage falls toward zero and is maximum in the opposite direction (leading) when the audio reaches its maximum negative value.

46. Buffer

(fig. 18)

The output of the phase modulator is fed to the control grid of buffer tube V304 through coupling capacitor C313. Grid current flowing through grid leak resistor R309 provides operating bias. The plate of tube V304 receives its plate voltage through decoupling resistor R311 which is bypassed for r-f voltages by capacitor C315B. The tuned circuit composed of capacitor C317 and inductance L303 is resonated at the crystal fre-

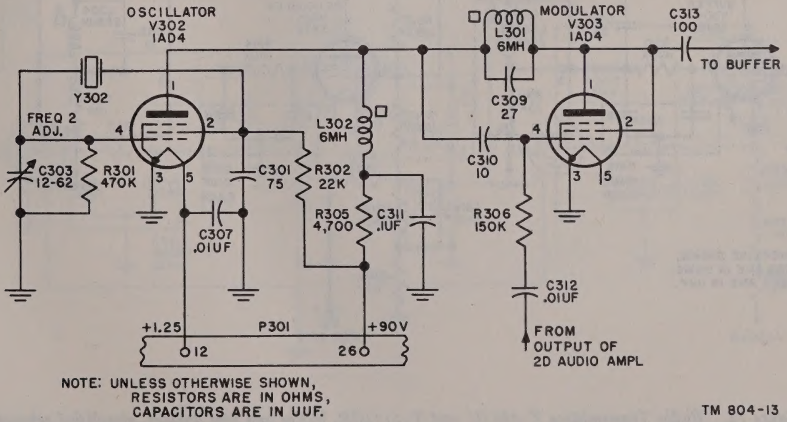

OSCILLATOR
V302
1AD4
Y302
FREQ 2
ADJ.
C303
12-62
R301
470K
1
2
3
4
5
C301
75
C307
.01UF
R302
22K
L302
6MH
R305
4,700
C311
.1UF
+1.25
P301
+90V
12
26
L301
6MH
MODULATOR
V303
1AD4
C309
27
C310
10
R306
150K
C312
.01UF
FROM
OUTPUT OF
2D AUDIO AMPL
C313
100
TO BUFFER
NOTE: UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.
TM 804-13

Figure 16. Radio Transmitters T–208/U and T–417/GR, crystal oscillator and modulator, simplified schematic.

quency. Resistor R310 is the screen voltage-dropping resistor. Capacitor C315A bypasses the screen grid to ground. The output voltage developed across plate load impedance Z301 is coupled to the control grid of tube V305 by capacitor C318.

47. Frequency Multiplication

The output of the modulator stage is phase-modulated r-f at the crystal frequency, with a deviation of 937.5 cycles for 100 percent modulation. Subsequent frequency multiplication (16 times) is necessary to produce the desired 15-kc

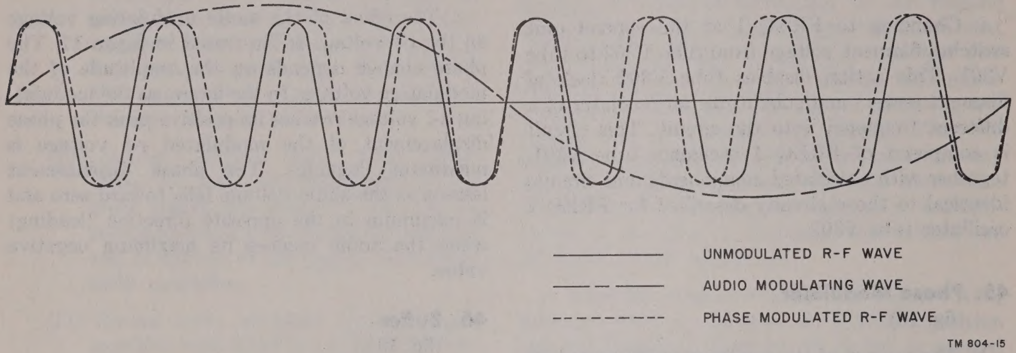

UNMODULATED R-F WAVE
AUDIO MODULATING WAVE
PHASE MODULATED R-F WAVE
TM 804-15

Figure 17. Phase modulation.

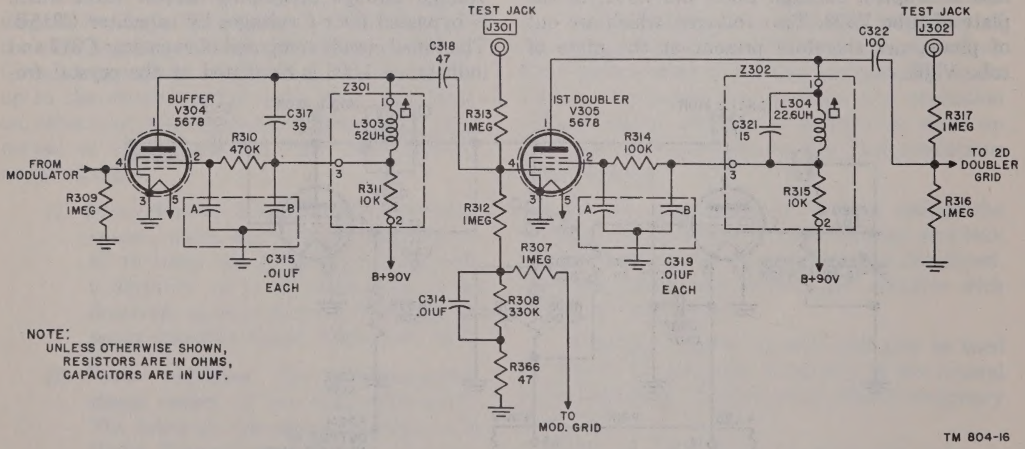

TEST JACK
J301
C318
47
Z301
BUFFER
V304
5678
C317
39
R310
470K
L303
52UH
FROM MODULATOR
R309
1MEG
A
B
R311
10K
C315
.01UF
EACH
B+90V
R313
1MEG
R312
1MEG
1ST DOUBLER
V305
5678
R314
100K
R307
1MEG
C314
.01UF
R308
330K
R366
47
TO MOD. GRID
C319
.01UF
EACH
TEST JACK
J302
C322
100
Z302
L304
22.6UH
C321
15
R315
10K
B+90V
R317
1MEG
TO 2D DOUBLER GRID
R316
1MEG
NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.
TM 804-16

Figure 18. Radio Transmitters T–208/U and T–417/GR, buffer and first doubler, simplified schematic.

deviation at the output frequency. This is accomplished by the four frequency doubler stages.

a. First Doubler (fig. 18). The grid circuit of the first doubler (V305) is returned to ground through resistors R312, R308, and R366, and a bias is developed for the tube. A portion of this bias is fed back to the modulator tube grid. An avc (automatic volume control) action takes place, cancelling any amplitude modulation of the phase-modulated signal due to excess modulation. Test jack J301 which is connected through isolating resistor R313 to the control grid of tube V305 is used to determine the general level of signal input voltage by measuring the bias voltage with no audio input. The plate of tube V305 receives its operating plate voltage through decoupling resistor R315, which is bypassed for r-f voltages by capacitor C319B. The tuned circuit composed of capacitor C321 and inductance L304 is resonated at *twice* the crystal frequency. Resistor R314 is the screen voltage-dropping resistor. Capacitor C319A bypasses the screen grid to ground. The output voltage developed across plate load impedance Z302 is coupled to the control grid of tube V306 by capacitor C322.

b. Second Doubler (fig. 19). Tube V306 doubles the frequency of the previous stage. Signal input is applied to the control grid through coupling capacitor C322. Rectified grid current flowing through grid leak resistor R316 provides operating bias and indicates the general level of signal input. This level is checked at jack J302, connected to the control grid through isolating resistor R317. Voltage indications at this test point are used when tuning the first doubler stage. The plate of tube V306 receives its operating plate voltage through decoupling resistor R319, which is bypassed for r-f voltages by capacitor C323B. The plate circuit is tuned to four times the crystal frequency by variable plate inductance L305. R-f voltage developed across the plate load impedance Z303 is coupled to the control grid of tube V307 by coupling capacitor C326. Resistor R318 is the screen voltage-dropping resistor. Capacitor C323A bypasses the screen grid to ground. Resistor R321 drops the filament voltage to the proper operating value and provides regulation and flexibility so that both transmitters may use the same power supply.

c. Third Doubler (fig. 19). Tube V307 doubles the frequency of the previous stage. Signal input is applied to the control grid of tube V307 through coupling capacitor C326. Rectified grid current flowing through grid leak resistor R320 provides operating bias and indicates the general level of signal input. This level is checked at jack J303, connected to the control grid through isolating resistor R322. Voltage indications at this test point are used as a guide when tuning the second doubler output and the third doubler input. Grid tank circuit Z304 tunes the grid circuit to four

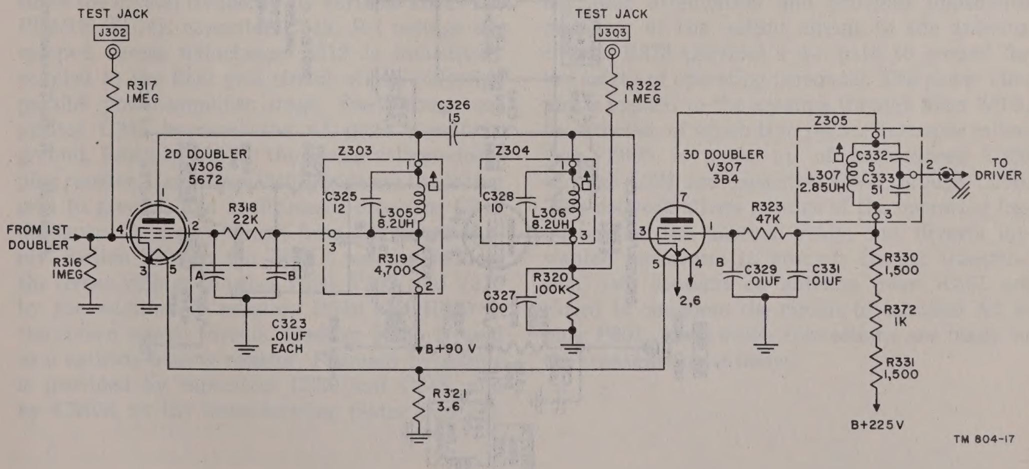

TEST JACK
J302
R317
1 MEG
C326
1.5
TEST JACK
J303
R322
1 MEG
Z305
2D DOUBLER
V306
5672
Z303
Z304
3D DOUBLER
V307
3B4
C332
5
L307
2.85UH
C333
51
TO DRIVER
C325
12
C328
10
L305
8.2UH
L306
8.2UH
R318
22K
R323
47K
FROM 1ST DOUBLER
R316
1MEG
A
B
R319
4,700
R320
100K
C329
.01UF
C331
.01UF
R330
1,500
C327
100
2,6
R372
1K
C323
.01UF
EACH
B+90 V
R331
1,500
R321
3.6
B+225V
TM 804-17

Figure 19. Radio Transmitters T–208/U and T–417/GR, second and third doubler, simplified schematic.

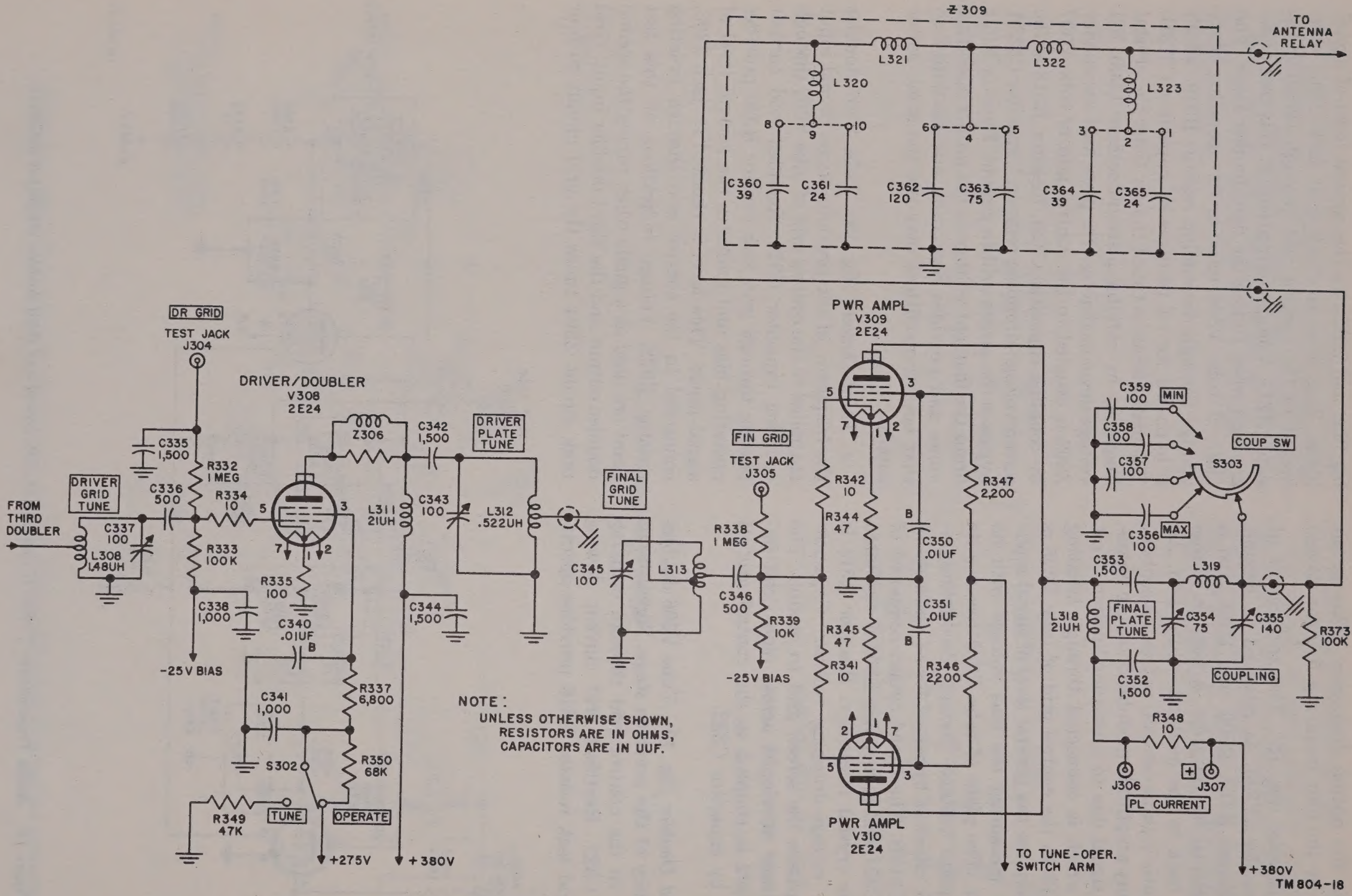

Z309
TO ANTENNA RELAY
L320
L321
L322
L323
8
9
10
6
4
5
3
2
1
C360 39
C361 24
C362 120
C363 75
C364 39
C365 24
DR GRID
TEST JACK J304
DRIVER/DOUBLER V308 2E24
DRIVER GRID TUNE
FROM THIRD DOUBLER
C335 1,500
R332 1 MEG
C336 500
R334 10
C337 100
L308 1.48UH
R333 100K
C338 1,000
-25V BIAS
Z306
C342 1,500
DRIVER PLATE TUNE
L311 21UH
C343 100
L312 .522UH
R335 100
C340 .01UF
B
C344 1,500
C341 1,000
R337 6,800
S302
R350 68K
R349 47K
TUNE
OPERATE
+275V
+380V
FINAL GRID TUNE
C345 100
L313
FIN GRID
TEST JACK J305
R338 1 MEG
C346 500
R339 10K
-25V BIAS
NOTE: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
PWR AMPL V309 2E24
R342 10
R344 47
R345 47
R341 10
C350 .01UF
C351 .01UF
R347 2,200
R346 2,200
PWR AMPL V310 2E24
TO TUNE-OPER. SWITCH ARM
C359 100
MIN
C358 100
C357 100
C356 100
MAX
COUP SW
S303
C353 1,500
L319
L318 21UH
FINAL PLATE TUNE
C354 75
C355 140
C352 1,500
COUPLING
R373 100K
R348 10
J306
J307
PL CURRENT
+380V
TM 804-18

Figure 20. Radio Transmitters T–208/U driver/doubler and power amplifiers, simplified schematic.

times the crystal frequency and helps to suppress harmonics. The plate of tube V307 receives its operating plate voltage through inductance L307. Capacitor C331 bypasses the r-f plate circuit to ground, and resistors R330, R372, and R331 act as isolating and decoupling resistors to prevent r-f voltages from getting into the plate supply. The plate circuit is tuned to eight times the crystal frequency by variable plate inductance L307. R-f voltage developed across capacitor C333 is coupled by a shielded cable to the driver grid tank circuit. Resistor R323 is the screen voltage-dropping resistor. Capacitor C329B bypasses the screen grid to ground.

d. Driver/Doubler (fig. 20). Tube V308 doubles the frequency of the previous stage. Signal input is coupled through capacitor C333 to inductance L308. Inductance L308 and variable DRIVER GRID TUNE capacitor C337 make up a grid tank circuit which is tuned to eight times the crystal frequency. Capacitor C336 couples the tank output to the control grid of tube V308. DR GRID jack J304, connected to the grid input through resistor R332, provides a test point from which grid voltage at the driver/doubler grid may be measured when tuning the third doubler stage and the grid tank circuit of tube V308. Protective bias of −25 volts is applied to the grid through resistor R333. The plate of tube V308 receives its operating plate voltage through L311 and Z306. The plate circuit is tuned to 16 times the crystal frequency by variable DRIVER PLATE TUNE capacitor C343. R-f voltage developed across inductance L312 is inductively coupled to the final grid circuit of the following parallel power-amplifier stage. Feedthrough capacitor C344 bypasses the r-f plate circuit to ground. Resistor R337 is the screen voltage-dropping resistor. Capacitor C340B bypasses the screen grid to ground, and feedthrough capacitor C341 decouples the screen circuit from the screen supply. Switch S302 in the TUNE position reduces the screen voltage to tubes V308, V309, and V310 by the addition of resistors R349 and R350 in the screen supply circuit. Resistor R335 is used as a cathode-biasing resistor. Filament bypassing is provided by capacitors C339 and C348, and by C340A at the beam-forming plates (fig. 31).

48. Power Amplifiers and Antenna Filter

(fig. 20)

The power-amplifier input is taken by the shielded cable through the partition and fed to the grid tank composed of variable capacitor C345 (FINAL GRID TUNE) and tapped inductance L313. The tank is tuned to 16 times the oscillator frequency. The input to the power-amplifier grids is connected through capacitor C346 and two parasitic suppressor resistors, R341 and R342, one for each grid lead. Jack J305 (FIN GRID) is provided to measure the input to the power-amplifier grids through resistor R338. The tubes operate as power amplifiers in parallel. The screen voltage is supplied from the TUNE-OPERATE switch through separate dropping resistors, R346 and R347. Capacitors C350B and C351B bypass the screens for r-f. Plate voltage is supplied through resistor R348 and inductance L318 which, in conjunction with C352, keeps the r-f current from the power supply. Resistor R348 provides a means of measuring the final amplifier plate current by measuring the voltage dropped across the resistor. The pi tuning network composed of C354, L319, C355, C356, C357, C358, and C359 constitutes the plate tank and antenna coupling circuits. FINAL PLATE TUNE capacitor C354 resonates the circuit while the COUP SW (S303) selects the approximate amount of coupling. The fine coupling adjustment is made by COUPLING capacitor C355. The pi circuit offers considerable harmonic attenuation and provides impedance matching of the output circuit to the antenna circuit. R373 provides a d-c path to ground for the safety of operating personnel. The power output is applied to the antenna through filter Z309, the function of which is to reduce harmonic radiation. Z309 is made up of inductances L320 through L323 and capacitors C360 through C365. This network allows passage of the operating frequency to the antenna relay, but diverts unwanted harmonics to ground. During transmission, two contacts on antenna relay K301 are closed to complete the circuit to terminal A2 of plug P301, from which connections are made to the transmitting antenna.

49. First Audio Amplifier
(fig. 21)

Microphone input is applied from terminal 13 of plug P301 to the 150-ohm impedance terminal of matching transformer T301. Resistor R371 serves as an impedance balance shunt across the secondary. Audio signals pass from the secondary of transformer T301 through a high-pass RC (resistor-capacitor) network made up of capacitor C373 and resistor R370, and then through resistor R369 to the control grid of tube V311. A bias voltage is fed to the grid through resistors R359, R360, R361, R370, and R369. Protection against excessively high audio input is provided by resistor R369. Plate voltage is applied through plate load resistor R364 and the decoupling network of R365 bypassed by capacitor C372. Resistors R374 and R358 form a voltage-divider network across the plate supply, from which screen voltage is applied through voltage-dropping resistor R358. Resistors R368 and R367 provide a hum-bucking network by establishing a grid circuit return to a center point of the filament. Capacitor C370 couples the output of the first audio amplifier to the following limiter stage.

50. Limiter
(fig. 21)

Amplified audio signals coupled through capacitor C370 are impressed on the control grid of limiter tube V312 through limiting resistor R363. Grid bias voltage is fed to resistor R363 through grid load resistor R362. Plate voltage is applied through plate load resistor R357. The limiter output is applied to a network composed of low-pass RC filter R356 and capacitor C368. Coupling to the grid of tube V313 is made through blocking capacitor C367.

51. Second Audio Amplifier
(fig. 21)

Tube V313 is the final audio amplifier and is used to drive phase-modulator tube V303. R355 is the grid load resistor. Bias is supplied from resistor R367 which is part of a voltage-divider network across the −25-volt supply. The plate of tube V313 receives operating voltage through plate load resistor R354. The variable tap of resistor R354 (a control) is used as an adjustment of the audio level to be applied to the phase modulator. This adjustment controls the DEVIATION LEVEL. The audio output voltage is applied to the phase-modulator stage through C312 and R353. Resistor R352 connects to the filament center point (R366 and R368) to provide hum-bucking action. The plate of tube V313 is connected to the control grid through capacitor C366 to provide inverse feedback.

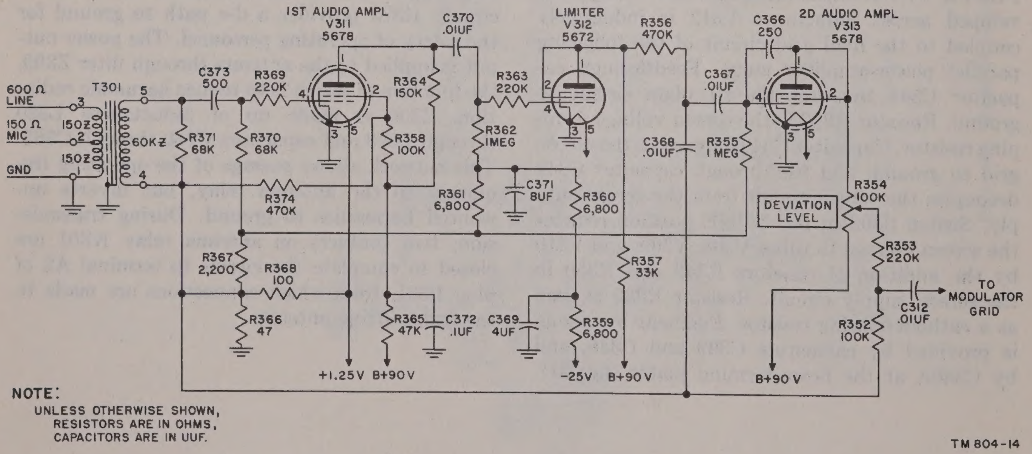

1ST AUDIO AMPL
V311
5678
C370
.01UF
LIMITER
V312
5672
R356
470K
C366
250
2D AUDIO AMPL
V313
5678
600 Ω LINE
150 Ω MIC
GND
T301
150Z
150Z
60KZ
C373
500
R369
220K
R364
150K
R363
220K
C367
.01UF
R371
68K
R370
68K
R358
100K
R362
1MEG
C368
.01UF
R355
1 MEG
R374
470K
R361
6,800
C371
8UF
R360
6,800
DEVIATION LEVEL
R354
100K
R367
2,200
R368
100
R357
33K
R353
220K
C312
.01UF
TO MODULATOR GRID
R366
47
R365
47K
C372
.1UF
C369
4UF
R359
6,800
R352
100K
+1.25V
B+90V
−25V
B+90 V
B+90 V
NOTE:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
TM 804-14

Figure 21. Radio Transmitters T–208/U and T–417/GR, audio stages, simplified schematic.

52. B+ Distribution

a. Figure 22 shows the B+ distribution in Radio Transmitters T–208/U and T–417/GR. TUNE-OPERATE switch S302 in the TUNE position places resistor R350 in series with the normal screen voltage-dropping resistors, R337, R346, and R347, limiting the plate current of the driver and power-amplifier stages to a value that will not harm the tubes if the stages are detuned or misalined. Resistor R349 serves as an additional load for the screen supply when operating with switch S302 in the TUNE position.

b. Terminal 3 of plug P301 applies 225 volts d-c to a voltage-divider network consisting of resistors R329, R328, R327, R326, R325, R324, and R351, and filter capacitors C334A, C334B, and C330. A potential of ninety volts d-c is tapped at the junction of resistors R325 and R326 and brought to terminal 27 of plug P301. Through external connections the voltage is applied to the transmitter at terminal 26 of plug P301, from which point it provides plate voltage for tubes V301 through V303. This voltage also is connected, through the cabinet, to the radio receiver for squelch operation.

c. The final 2-volt d-c output at the voltage divider is connected to terminal 15 of plug P301. External connections supply this voltage to the handset to provide microphone current.

53. Filament Voltage Distribution

Figure 23 is a schematic diagram illustrating the distribution of filament power for Radio Transmitter T–208/U used with Dynamotor-Power Supply DY–100/U. Controls which are external to the transmitter (par. 54) allow completion of circuits from the system battery to plug P301 of the transmitter. Terminals 1, 7, 8, 11, 12, 16, and 28 of plug P301 supply the crystal heating element and all tube filaments with power.

54. Control Circuits
(fig. 24)

The following description of control circuits is based on the use of Radio Transmitter T–208/U used with Radio Set AN/VRC–6(*). The power supply employed is the mobile, 6-volt, d-c powered unit, Dynamotor-Power Supply DY–100/U.

a. The extensive system of interconnection between units makes it necessary to identify the plugs, jacks, and terminal boards involved.

(1) Plug P301 is a part of Radio Transmitter T–208/U and plugs into jack J801 located inside Electrical Equipment Cabinet CY–938/VRC.

(2) Plug P1203 is a part of Dynamotor-Power Supply DY–100/U and plugs into jack J802 located inside Electrical Equipment Cabinet CY–938/VRC.

(3) Plug P252 is a part of Radio Receiver R–257/U and plugs into jack J803 located inside Electrical Equipment Cabinet CY–938/VRC.

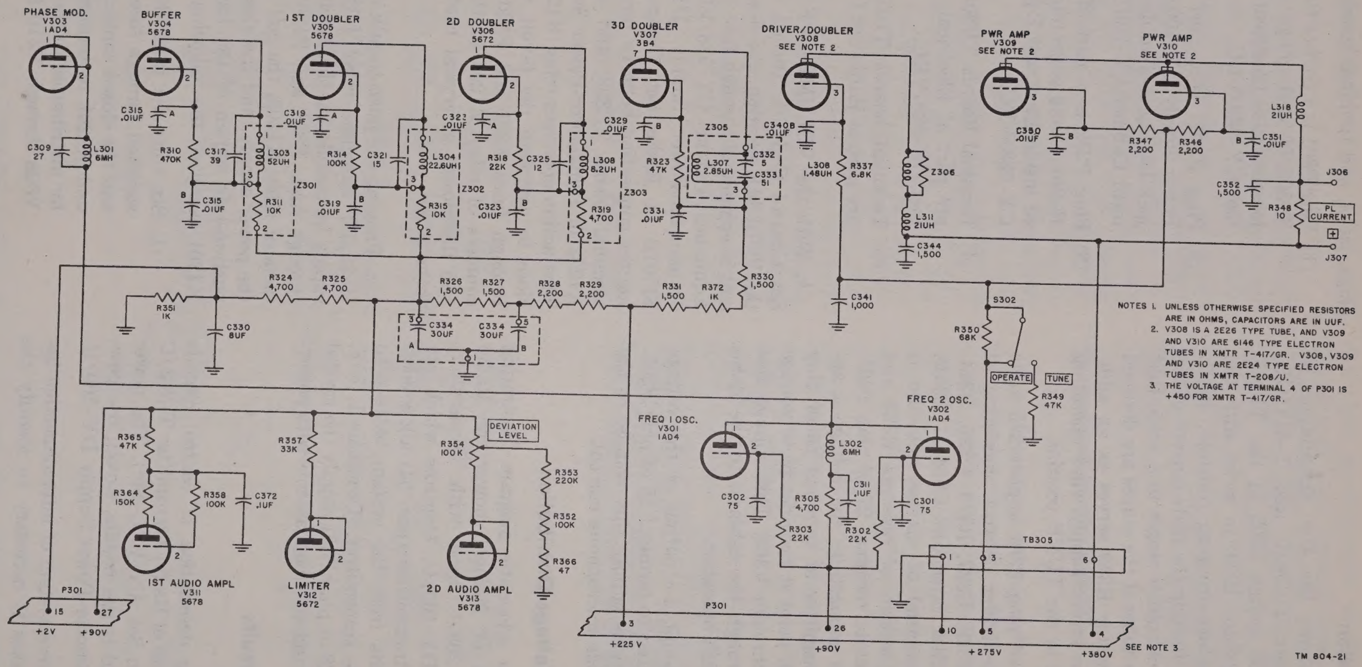
(4) Terminal Boards TB801 through TB806 are part of Electrical Equipment Cabinet CY–938/VRC.

(5) Terminal boards TB1501 and TB1502 are part of Radio Set Control C–847/U.

b. With the VOLUME-OFF switch on Radio Set Control C–847/U turned clockwise toward the VOLUME position, the 6-volt d-c power circuit is completed through fuse F801 in Electrical Equipment Cabinet CY–938/VRC, fuse F1201 in Dynamotor-Power Supply DY–100/U, switch S1501B in Radio Set Control C–847/U, the jumper connection between terminals 1 and 2 of terminal board TB803, and the coil of relay K1203 in Dynamotor-Power Supply DY–100/U. This action energizes relay K1203. Two contacts close to complete the 6-volt d-c power circuit through fuses F801 and F1201 and the closed contacts of relay K1203 to the heater element and thermostat of crystal heater HR301 in the transmitter.

c. Pressing the push-to-talk switch on Handset H–33/PT energizes relay K1201 in the power supply by completing the 6-volt d-c power circuit through fuses F801 and F1201, the closed contacts of relay K1203, the coil of relay K1201 in the power supply, and the closed contacts of the push-to-talk switch of the handset. With relay K1201 energized the following action occurs:

(1) Six volts d-c from the power source is supplied through fuses F801 and F1201 and the closed contacts of relays K1203 and K1201 to terminal 1 of plug P301 for distribution to the filaments of tubes V308 through V310 in the transmitter.


PHASE MOD.
V303
1AD4
BUFFER
V304
5678
1ST DOUBLER
V305
5678
2D DOUBLER
V306
5672
3D DOUBLER
V307
3B4
DRIVER/DOUBLER
V308
SEE NOTE 2
PWR AMP
V309
SEE NOTE 2
PWR AMP
V310
SEE NOTE 2
C309 27
L301 6MH
C315 .01UF
R310 470K
C317 39
L303 52UH
R311 10K
Z301
C319 .01UF
R314 100K
C321 15
L304 22.6UH
R315 10K
Z302
C323 .01UF
R318 22K
C325 12
L308 8.2UH
R319 4,700
Z303
C329 .01UF
R323 47K
C331 .01UF
L307 2.85UH
C332 5
C333 51
Z305
C340B .01UF
L308 1.48UH
R337 6.8K
Z306
L311 21UH
C344 1,500
C341 1,000
C350 .01UF
R347 2,200
R346 2,200
C351 .01UF
L318 21UH
C352 1,500
R348 10
PL CURRENT
J306
J307
R324 4,700
R325 4,700
R351 1K
C330 8UF
R326 1,500
R327 1,500
R328 2,200
R329 2,200
R331 1,500
R372 1K
R330 1,500
C334 30UF
C334 30UF
S302
R350 68K
OPERATE
TUNE
R349 47K
FREQ 1 OSC.
V301
1AD4
FREQ 2 OSC.
V302
1AD4
C302 75
L302 6MH
R305 4,700
R303 22K
C311 .1UF
R302 22K
C301 75
TB305
R365 47K
R364 150K
R358 100K
C372 .1UF
R357 33K
R354 100K
DEVIATION LEVEL
R353 220K
R352 100K
R366 47
1ST AUDIO AMPL
V311
5678
LIMITER
V312
5672
2D AUDIO AMPL
V313
5678
P301
15
27
+2V
+90V
P301
3
26
10
5
4
+225 V
+90V
+275V
+380V
SEE NOTE 3
TM 804-21

NOTES 1. UNLESS OTHERWISE SPECIFIED RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

2. V308 IS A 2E26 TYPE TUBE, AND V309 AND V310 ARE 6146 TYPE ELECTRON TUBES IN XMTR T-417/GR. V308, V309 AND V310 ARE 2E24 TYPE ELECTRON TUBES IN XMTR T-208/U.

3. THE VOLTAGE AT TERMINAL 4 OF P301 IS +450 FOR XMTR T-417/GR.

Figure 22. *Radio Transmitters T–208/U and T–417/GR. B+ distribution. simplified schematic.*

(2) The 1.3-volt d-c supply is obtained by connection of the 6-volt d-c power circuit through fuses F801 and F1201 and the closed contacts of relays K1203 and K1201 to the voltage-dropping and regulating circuit in the power supply composed of resistor R1201, current regulators RT1201 and RT1202, and inductance L1201. The circuit then is completed to terminals 16 and 28 of plug P301 for distribution to the filaments of tubes V303 through V307 and V311 through V313 in the transmitter.

(3) The 1.3-volt d-c supply is tapped in the cabinet and sent through FREQ selector switch S1503 in the radio set control to terminal 11 or 12 of plug P301 for distribution to tube V301 or V302 in the transmitter. The radio set control switch determines which tube receives filament voltage.

(4) Six volts d-c is supplied from the power source through fuses F801 and F1201 and the closed contacts of relays K1203 and K1201 to the coil of relay K301 in the transmitter at terminal 29 of plug P301. This action energizes relay K301 and thereby connects the r-f power output of the transmitter to the antenna. The TRANSMIT indicator lamp in the radio set control will light.

(5) Six volts d-c is supplied from the power source through fuses F801 and F1201 and the closed contacts of relays K1203 and K1201 to the coil of relay K1202. This energizes the relay.

d. With relay K1202 energized, 6 volts d-c from the power source is supplied through fuse F801 and the closed contacts of relay K1202 to dynamotor D1201 in the power supply. The dynamotor operates and supplies power to the following circuits.

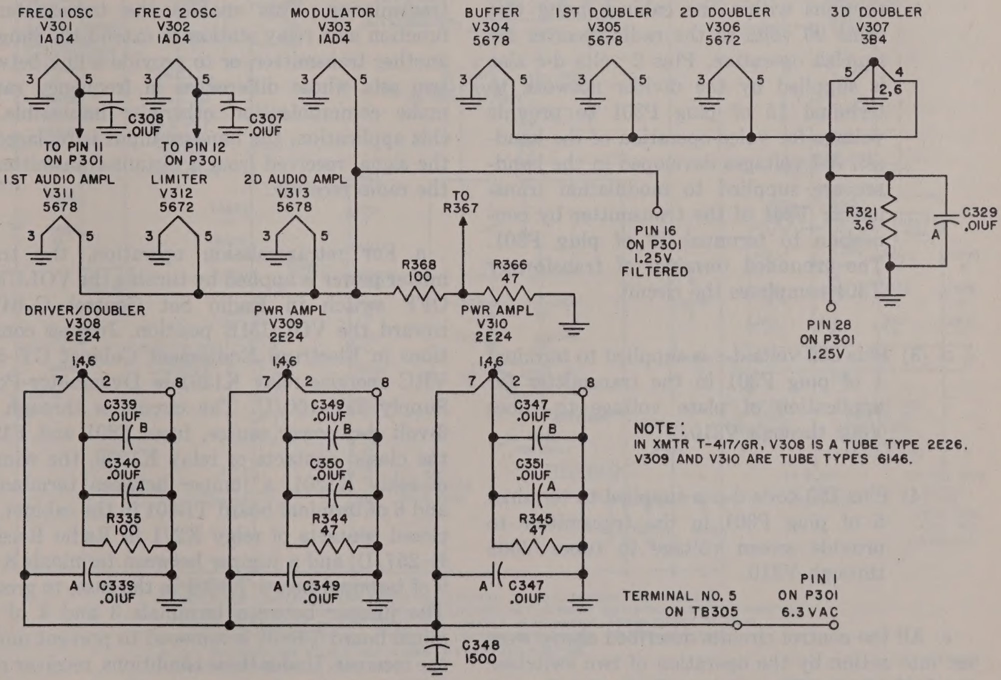

FREQ 1 OSC
V301
1AD4
FREQ 2 OSC
V302
1AD4
MODULATOR
V303
1AD4
BUFFER
V304
5678
1ST DOUBLER
V305
5678
2D DOUBLER
V306
5672
3D DOUBLER
V307
3B4
3
5
4
2,6
C308
.01UF
C307
.01UF
TO PIN 11
ON P301
TO PIN 12
ON P301
1ST AUDIO AMPL
V311
5678
LIMITER
V312
5672
2D AUDIO AMPL
V313
5678
TO
R367
R368
100
R366
47
PIN 16
ON P301
1.25V
FILTERED
R321
3.6
C329
.01UF
A
PIN 28
ON P301
1.25V
DRIVER/DOUBLER
V308
2E24
PWR AMPL
V309
2E24
PWR AMPL
V310
2E24
1,4,6
7
2
8
C339
.01UF
B
C340
.01UF
A
R335
100
C339
.01UF
C349
.01UF
C350
.01UF
R344
47
C349
.01UF
C347
.01UF
C351
.01UF
R345
47
C347
.01UF
NOTE:
IN XMTR T-417/GR, V308 IS A TUBE TYPE 2E26.
V309 AND V310 ARE TUBE TYPES 6146.
TERMINAL NO. 5
ON TB305
PIN 1
ON P301
6.3 VAC
C348
1500

Figure 23. Radio Transmitters T–208/U and T–417/GR, filament circuit, simplified schematic.

(1) Minus 25 volts d-c is supplied to terminal 6 of plug P301 in the transmitter for application to a filter and voltage-divider network which proportions the bias voltage to tubes V308 through V313.

(2) Plus 225 volts d-c is supplied to terminal 3 of plug P301 in the transmitter to provide plate and screen voltage to tube V307. A filter and voltage-divider network also receives the +225-volt input. Plus 90 volts d-c from the divider is supplied to the plate and screen circuits of tubes V304 through V306 and V311 through V313. This +90 volts also is connected to terminal 27 of plug P301 in the transmitter. From this point the circuit is completed externally, through the closed contacts of relay K1201 in the power supply and back to the transmitter at terminal 26 of plug P301. This terminal supplies plate and screen voltage to tubes V301 through V303. Connections within the cabinet bring this same 90 volts to the radio receiver for squelch operation. Plus 2 volts d-c also is supplied by the divider network to terminal 15 of plug P301 to provide voltage for voice operation of the handset. A-f voltages developed in the handset are supplied to modulation transformer T301 of the transmitter by connection to terminal 13 of plug P301. The grounded terminal of transformer T301 completes the circuit.

(3) Plus 380 volts d-c is supplied to terminal 4 of plug P301 in the transmitter for application of plate voltage to tubes V308 through V310.

(4) Plus 180 volts d-c is supplied to terminal 5 of plug P301 in the transmitter to provide screen voltage to tubes V308 through V310.

e. All the control circuits described above were set into action by the operation of two switches: the VOLUME-OFF switch at Radio Set Control C–847/U and the push-to-talk switch of Handset H–33/PT. During the initial tuning procedure, TEST-OFF switch S301 in the transmitter is used instead of the push-to-talk switch of the handset. Switch S301 parallels the handset switch and energizes relay K1201 in the power supply in the same manner as did the handset switch. The circuit is from the 6-volt d-c source through fuses F801 and F1201, the closed contacts of relay K1203, the coil of K1201, and through switch S301 of the transmitter in the TEST position to ground. Power this is applied to the transmitter in the same sequence as described for handset operation.

f. In Radio Transmitter T–417/GR, +450 volts d-c is supplied at terminal 4 instead of 380 volts as in Radio Transmitter T–208/U.

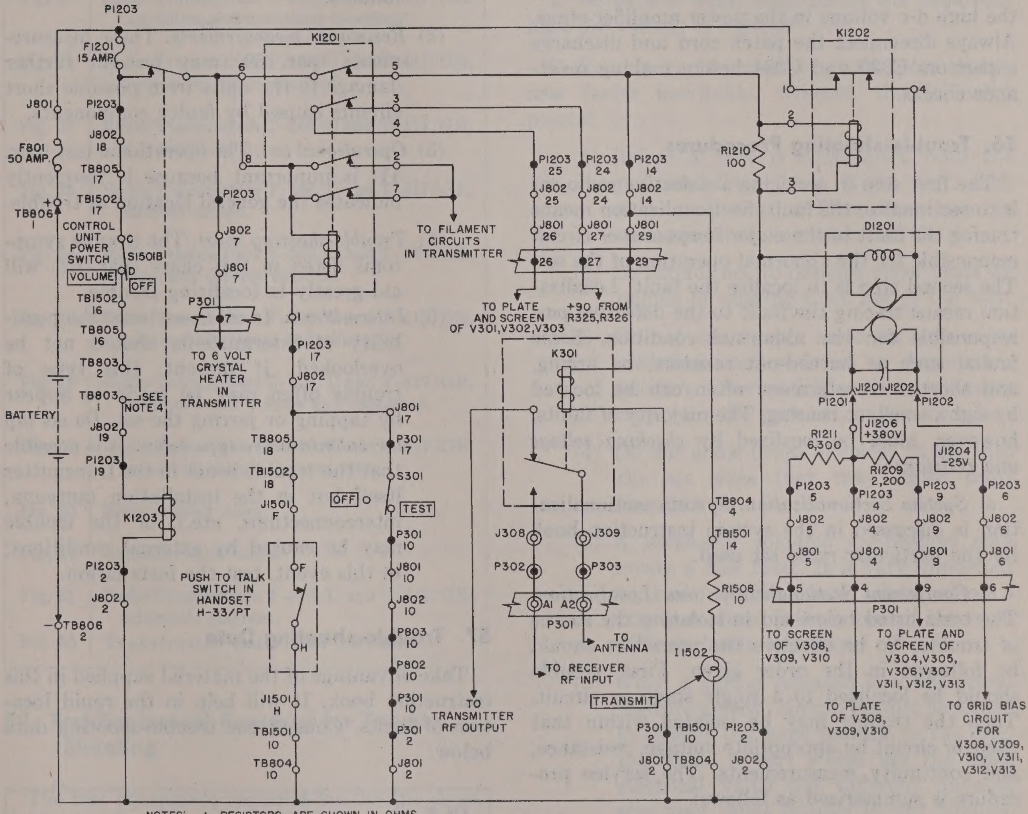
55. Retransmission Circuits

An adaptation of push-to-talk operation is retransmission. This enables the transmitter to function as a relay station to extend the range of another transmitter, or to provide a link between two sets whose differences in frequency ranges make communication otherwise impossible. In this application, the handset input is replaced by the signal received from a distant transmitter by the radio receiver.

a. For retransmission operation, the transmitter power is applied by turning the VOLUME-OFF switch in Radio Set Control C–847/U toward the VOLUME position. Jumper connections in Electrical Equipment Cabinet CY–938/VRC energize relay K1201 in Dynamotor-Power Supply DY–100/U. The circuit is through the 6-volt d-c power source, fuses F801 and F1201, the closed contacts of relay K1203, the winding of relay K1201, a jumper between terminals 5 and 6 of terminal board TB801 in the cabinet, the closed contacts of relay K271 in Radio Receiver R–257/U, and a jumper between terminals 8 and 9 of terminal board TB801 in the case, to ground. The jumper between terminals 3 and 4 of terminal board TB801 is removed to prevent muting the receiver. Under these conditions, receiver relay K271 is energized whenever audio output is present and completes the circuit for application of power to the transmitter.

b. The audio output of the radio receiver, which is the signal to be retransmitted, is fed to the transmitter at terminal 14 of plug P301. Terminal 14 is the 600-ohm line input which connects to terminal 3 of modulation transformer T301. Terminal 1 of T301 is grounded, providing a completed circuit.

c. The transmitter now is modulated by a received audio signal. An additional antenna is necessary to serve the receiver, as are various jumper arrangements in the cabinet. Refer to the system instruction book for retransmission.



P1203 1
F1201 15 AMP
K1201
K1202
J801 1
P1203 18
J802 18
F801 50 AMP.
TB805 17
TB1502 17
TB806 1
CONTROL UNIT POWER SWITCH
S1501B
VOLUME
OFF
TB1502 16
TB805 16
TB803 2
TB803 1
SEE NOTE 4
BATTERY
J802 19
P1203 19
K1203
P1203 2
J802 2
TB806 2
P1203 7
J802 7
J801 7
P301 7
TO 6 VOLT CRYSTAL HEATER IN TRANSMITTER
TO FILAMENT CIRCUITS IN TRANSMITTER
P1203 17
J802 17
J801 17
TB805 18
P301 17
TB1502 18
S301
OFF
TEST
J1501 F
P301 10
J801 10
J802 10
P803 10
P802 10
P301 10
PUSH TO TALK SWITCH IN HANDSET H-33/PT
J1501 H
TB1501 10
TB804 10
P301 2
J801 2
TO TRANSMITTER RF OUTPUT
P1203 25
J802 25
J801 26
P1203 24
J802 24
J801 27
P1203 14
J802 14
J801 29
26
27
29
TO PLATE AND SCREEN OF V301,V302,V303
+90 FROM R325,R326
K301
J308
J309
P302
P303
A1
A2
P301
TO ANTENNA
TO RECEIVER RF INPUT
TB804 4
TB1501 14
R1508 10
I1502
TRANSMIT
P301 2
TB1501 10
P1203 2
J801 2
TB804 10
J802 2
R1210 100
D1201
J1201
J1202
P1201
P1202
J1206 +380V
R1211 6,300
R1209 2,200
J1204 -25V
P1203 5
P1203 4
P1203 9
P1203 6
J802 5
J802 4
J802 9
J802 6
J801 5
J801 4
J801 9
J801 6
P301
TO SCREEN OF V308, V309, V310
TO PLATE AND SCREEN OF V304,V305, V306,V307 V311, V312, V313
TO PLATE OF V308, V309, V310
TO GRID BIAS CIRCUIT FOR V308, V309, V310, V311, V312,V313

NOTES:
1. RESISTORS ARE SHOWN IN OHMS.
2. REFERENCE NUMBERS OF 300 SERIES ARE LOCATED IN RADIO TRANSMITTER T-208/U.
REFERENCE NUMBERS OF 800 SERIES ARE LOCATED IN ELECTRICAL EQUIPMENT CABINET CY-938/VRC.
REFERENCE NUMBERS OF 1200 SERIES ARE LOCATED IN DYNAMOTOR-POWER SUPPLY DY-100/U.
REFERENCE NUMBERS OF 1500 SERIES ARE LOCATED IN RADIO SET CONTROL C-847/U.
3. ALL SWITCHES AND RELAYS ARE SHOWN IN ENERGIZED POSITION.
4. JUMPER SHOWN FOR 6V OPERATION.

TM 804-19

Figure 24. Radio Transmitters T-208/U and T-417/GR, relay and control circuits, simplified schematic.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing Radio Transmitters T–208/U and T–417/GR be careful because of the high d-c voltage in the power amplifier stage. Always disconnect the patch cord and discharge capacitors C330 and C334 before making resistance checks.

56. Trouble-shooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults, such as burned-out resistors, r-f arcing, and shorted transformers, often can be located by sight, smell, or hearing. The majority of faults, however, must be localized by *checking voltage and resistance.*

a. System Sectionalization. System sectionalization is discussed in the system instruction book for the particular radio set used.

b. Component Sectionalization and Localization. The tests listed below aid in isolating the source of trouble. To be effective the procedure should be followed in the order given. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 40) is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the transmitter which might occur through improper servicing methods and in forestalling future failures.

(2) *Resistance measurements.* These measurements (par. 60) may prevent further damage to the units from possible short circuits caused by faulty components.

(3) *Operational test.* The operational test (par. 41) is important because it frequently indicates the general location of trouble.

(4) *Trouble-shooting chart.* The trouble symptoms listed in this chart (par. 62) will aid greatly in localizing trouble.

(5) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. *Do not tap the subminiature type tubes.* It is possible that the trouble is not in the transmitter itself but in the installation (antenna, interconnections, etc.), or the trouble may be caused by external conditions; in this event, test the installation.

57. Trouble-shooting Data

Take advantage of the material supplied in this instruction book. It will help in the rapid location of faults. Consult the trouble-shooting data below:

Fig. or Par. No.	Description
Fig. 3	Radio Transmitters T–208/U and T–417/GR, left side.
Fig. 4	Radio Transmitters T–208/U and T–417/GR, front and rear.

57. Trouble-shooting Data—(contd)

Fig. or Par. No.	Description
Fig. 5	Radio Transmitters T–208/U and T–417/GR, right side.
Fig. 6	Radio Transmitters T–208/U and T–417/GR, tube locations.
Fig. 8	Radio Transmitters T–208/U and T–417/GR, crystal oven E301, exploded view.
Fig. 9	Radio Transmitters T–208/U and T–417/GR, bottom view.
Fig. 10	Radio Transmitters T–208/U and T–417/GR, test points and alinement locations.
Fig. 14	Radio Transmitters T–208/U and T–417/GR, front view, panel removed.
Fig. 22	Radio Transmitters T–208/U and T–417/GR, B+ distribution.
Fig. 23	Radio Transmitters T–208/U and T–417/GR, filament circuit.
Fig. 24	Radio Transmitters T–208/U and T–417/GR, relay and control circuits.
Fig. 25	Radio Transmitters T–208/U and T–417/GR, tube socket voltage and resistance.
Fig. 26	Radio Transmitters T–208/U and T–417/GR, terminal board voltage and resistance.
Fig. 27	Radio Transmitters T–208/U and T–417/GR, exciter subchassis, bottom view.
Fig. 29	Resistor color codes.
Fig. 30	Capacitor color codes.
Fig. 31	Radio Transmitters T–208/U and T–417/GR, schematic diagram.
Par. 63	Transformer and coil d-c resistance.

58. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Radio Transmitters T–208/U and T–417/GR is listed in the following table. The technical manuals associated with the test equipment are also listed.

Test equipment	Technical manual
Multimeter TS–352/U...........	TM 11–5527
Electronic Multimeter TS–505/U..	TM 11–5511
Tube Tester I-177 or equal.......	TM 11–2627
Tube Test Data..................	TB 11–2627–2

59. General Precautions

Whenever the transmitter is serviced, observe the following precautions:

a. Be careful when dust covers are removed; high d-c voltage is exposed.

b. Careless replacement of parts often makes new faults inevitable. Observe the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer or filter, has a number of connections, tag each lead to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not use a large soldering iron when soldering small resistors or ceramic capacitors. Overheating of the small parts may ruin the part or change its value.

(4) Do not allow drops of solder to fall into the set since they may cause short circuits.

(5) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to locate.

(6) When a part is replaced in a vhf (very-high-frequency) circuit, it must be placed in exactly the same position as the original part. A part which has the same electrical value but different physical size may cause trouble in vhf circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in loss of oscillation, decreased output, or parasitic oscillations.

60. Checking B+ Circuits for Shorts

Figure 22 is a simplified schematic of the B+ distribution throughout the transmitter and the possible paths which could offer short circuits. By using this schematic in conjunction with the voltage and resistance measurements found in figures 25 and 26, the typical causes for trouble can be checked easily. If resistance is low, check for a shorted bypass capacitor in one of the plate or screen grid circuits, a short in the wiring in one of the plate or screen circuits, or leakage in a capacitor. If the B+ circuit is shorted in the decoupling network of one stage, it may drop the voltage so that several stages are affected. High resistance readings indicate defective resistors or an open circuit.

61. Operational Test

The operational test is used to check for the proper functioning of the transmitter. For this purpose a dummy antenna may be used instead of the regular transmitting antenna. Operate the transmitter as described in the equipment performance checklist (par. 41). Check that all functions described in the normal indications column are completed. Listen for crackling or buzzing noises which indicate high-voltage arcing. Check for smoke and the odor of burned or overheated parts.

62. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble in the transmitter. Transmitter operation depends on all system components. For this reason trouble shooting has been extended to cover possible faults in components external to the transmitter. Once the trouble has been localized to a stage or circuit of the transmitter, a tube check and voltage and resistance measurements of this stage or circuit ordinarily should be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figures 25 and 26.

62. Trouble-shooting Chart (contd)

Symptom	Trouble	Correction
1. Crystal oven does not heat..	1. System battery is discharged.................	1. Recharge or replace battery.
	Fuse F801 in Electrical Equipment Cabinet CY-938/VRC or fuse F1201 in Dynamotor-Power Supply DY-100/U is open.	Replace fuse.
	Switch S1501B in Radio Set Control C-847/U is defective.	Replace.
	Jumper connection between terminals 1 and 2 of terminal board TB803 in Electrical Equipment Cabinet CY-938/VRC is not connected.	Connect.
	Contacts of power distribution relay in power supply fail to close.	Repair and adjust.
	Defective plugs, jacks, or terminal boards (P301, P1203, J801, J802, TB803, TB805, TB806, TB1502).	Repair.
	Defective cable from radio set control to cabinet.	Repair or replace.
	Defective heater and thermostat in the crystal oven.	Replace.
2. No filament voltage for tube V301 or V302.	2. Power supply is not energized................	2. Refer to first seven items under 1.
	Contacts of relay K1201 in power supply fail to close.	Repair and adjust.

62. Trouble-shooting Chart (contd)

Symptom	Trouble	Correction
	Defective terminal board TB804 or TB1501	Repair.
	Defective push-to-talk switch on handset	Repair or replace handset.
	Defective tube	Replace.
	Defective components in the power supply (R1202, RT1201, RT1202, L1201).	Replace.
	Defective switch in the radio set control	Repair or replace.
3. No filament voltage for tubes V303 through V307 and V311 through V313.	3. Refer to first six items under 2	3. Refer to first six items under 2.
4. No filament voltage for tubes V308 through V310.	4. Refer to first five items under 2	4. Refer to first five items under 2.
	Shorted filament circuit elements	Check filament circuits (fig. 23) and repair defect.
5. No plate or screen voltage	5. Refer to first five items under 2	5. Refer to first five items under 2.
	Defective dynamotor in the power supply	Repair or replace.
	Shorted circuit elements	Check B+ distribution (fig. 22) and repair defect.
6. No microphone current for handset.	6. Refer to first four items under 2	6. Refer to first four items under 2.
	Defective components in the voltage-divider network (R324 through R329, R351, C330, and C334).	Replace.
	Open winding in transformer T301	Replace transformer.
7. Antenna relay does not operate.	7. Refer to first four items under 2	7. Refer to first four items under 2.
	Open winding in relay coil	Replace.
	Contacts of the relay do not function correctly	Repair and adjust.
8. Power is not applied to transmitter in the TEST position.	8. Defective switch S301	8. Replace.
9. Oscillator stage does not function correctly.	9. Defective crystal	9. Replace.
	Open or shorted bypass capacitor or tuning capacitor.	Replace.
	Defective tube V301 or V302	Replace.

Symptom	Trouble	Correction
10. One of the stages (V303 through V310) fails to function correctly.	10. Defective tube. No drive from the previous stage.	10. Replace.
	Open or shorted bypass capacitor, tuning capacitor, or coupling capacitor.	Repair or replace.
	Open or shorted resistors	Replace.
	Defective r-f coils	Replace.
	Wrong coil L319	Replace.
11. No r-f output from transmitter.	11. Defective COUP SW or components of coupling network C352 through C355, L318, and L319.	11. Replace.
	Defective COUP SW or capacitors (C356 through C359).	Replace.
	Defective R373	Replace.
	Incorrect antenna filter strap connections (par. 18) for the operating band.	Correct connections.
	Defect in components of the antenna filter (L320 through L323 and C360 through C365).	Replace.
	Defective contacts on the antenna relay	Repair and adjust.
12. Low or no grid drive to first audio amplifier tube V311.	12. Defective handset	12. Replace.
	Open winding in transformer T301	Replace.
	Defective coupling capacitor C373 or limiting resistor R369.	Replace.
	Resistor R371 is shorted	Replace.
	Defective resistors R370, R367, and R366	Replace.
13. No audio output from tube V313 to phase modulator.	13. Defective tubes (V311 through V313)	13. Replace.
	Defective coupling capacitors C367 and C370, or limiting resistor R363.	Replace.
	Defective components in the low-pass RC network (R356 and C368).	Replace.
	Shorted feedback capacitor C366	Replace.
	Faulty DEVIATION LEVEL control R354	Replace.
	Defective resistor R307 or capacitor C312	Replace.

63. D-c Resistances of Transformers and Coils

The d-c resistances of the transformer windings and the coils of Radio Transmitters T–208/U and T–417/GR are listed below:

Transformer or coil	Terminals	Ohms
T301	1-2	75
	1-3	150
	2-3	75
	4-5	5,000
K301		52
L301		Less than .1
L302	1-3	Less than .1
L303	1-3	9.1
L304	1-3	4
L305	1-3	1.1
L306	1-3	1.1
L307	1-3	1.1
L308		Less than .1
L311		2.6
L312		Less than .1
L313		Less than .1
L317		Less than .1
L318		2.6
L319		Less than .1
L320		Less than .1
L321		Less than .1
L322		Less than .1
L323		Less than .1

Section II. REPAIRS

64. Replacement of Parts

When replacing parts in Radio Transmitters T–208/U and T–417/GR, observe the precautions given in the adjoining column.

a. Tagging Leads. Tagging leads is essential to assure that correct rewiring will be made when a part is replaced. Use small tags or short pieces of adhesive tape to identify all wires in accordance with their connections. Identify every lead that is to be removed.

b. Parts and Substitutions. When damaged parts must be replaced, identical parts should be used. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must be of equal or higher voltage and current rating.

c. Location. Locate replaced or substituted parts in exactly the same position as that formerly occupied by the damaged part. Do not change the position of any part, especially parts in the r-f stages.

d. Mounting. Mount the replaced or substituted part in the same mounting as that formerly occupied by the damaged part. Fasten all mountings securely.

e. Soldering. Before soldering any connections, carefully scrape all parts that will be touched by the solder, until all traces of rust, corrosion, paint, or varnish are removed. Remove the scrapings with a small clean brush. Tin all surfaces to be soldered. Wrap the wire around the lug to obtain mechanical support. Use a small amount of solder to make the connection and use sufficient heat to make the solder flow evenly around the tinned surfaces.

f. Retropicalization. If the parts to be replaced require special treatment, such as retropicalization, follow the instructions given in the appropriate publication referred to in appendix I.

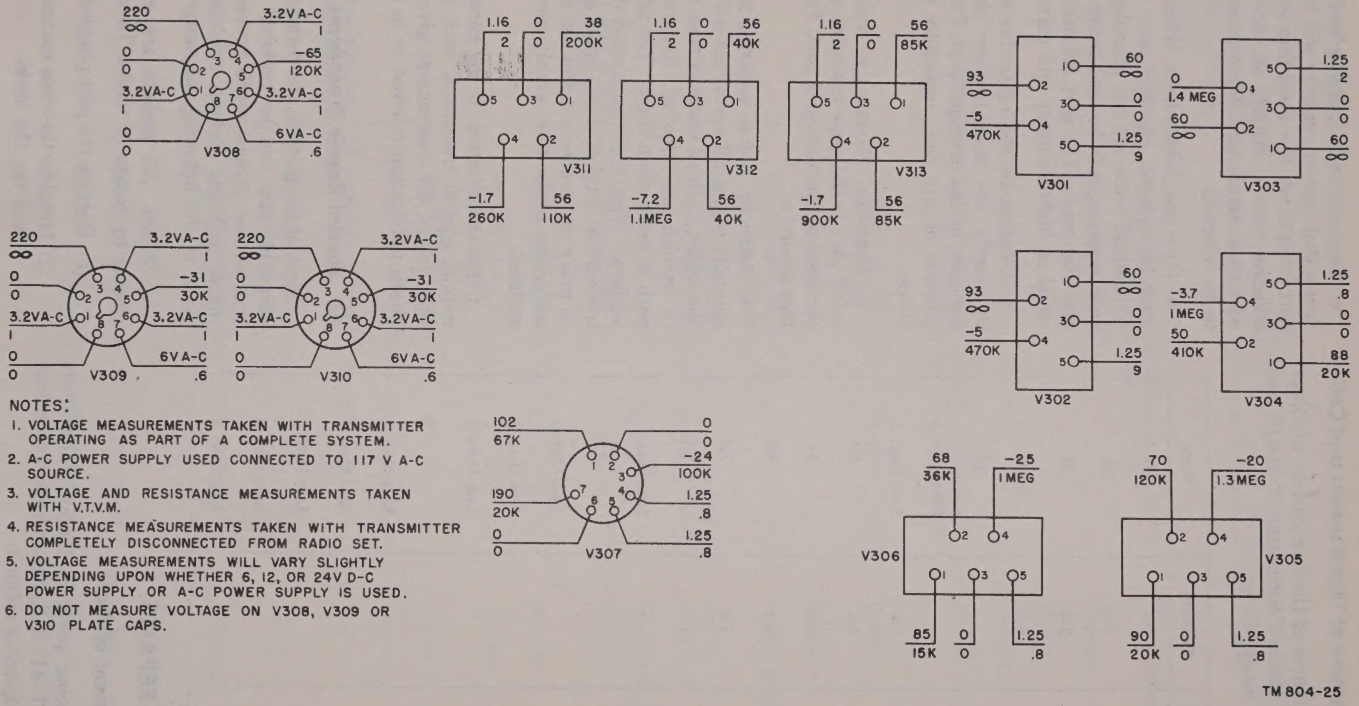
65. Special Repair Procedures

Most of the parts in the transmitter are readily accessible and can be replaced without special instructions. Special repair procedures for repairing or replacing sockets, crystals, and tubes are given in the following subparagraphs.

a. Sockets. All sockets are attached to the chassis by means of rivets. To change a socket:

(1) Remove the part plugged into the socket.

(2) Unsolder the wires connected to the socket and tag the leads.


220
∞
0
0
3.2VA-C
1
0
0
3.2V A-C
1
-65
120K
3.2VA-C
1
6VA-C
.6
V308
1.16
2
0
0
38
200K
-1.7
260K
56
110K
V311
1.16
2
0
0
56
40K
-7.2
1.1MEG
56
40K
V312
1.16
2
0
0
56
85K
-1.7
900K
56
85K
V313
93
∞
-5
470K
60
∞
0
0
1.25
9
V301
0
1.4 MEG
60
∞
1.25
2
0
0
60
∞
V303
220
∞
0
0
3.2VA-C
1
0
0
3.2VA-C
1
-31
30K
3.2VA-C
1
6V A-C
.6
V309
220
∞
0
0
3.2VA-C
1
0
0
3.2VA-C
1
-31
30K
3.2VA-C
1
6V A-C
.6
V310
93
∞
-5
470K
60
∞
0
0
1.25
9
V302
-3.7
1MEG
50
410K
1.25
.8
0
0
88
20K
V304
102
67K
190
20K
0
0
0
0
-24
100K
1.25
.8
1.25
.8
V307
68
36K
-25
1MEG
85
15K
0
0
1.25
.8
V306
70
120K
-20
1.3MEG
90
20K
0
0
1.25
.8
V305
TM 804-25

NOTES:

1. VOLTAGE MEASUREMENTS TAKEN WITH TRANSMITTER OPERATING AS PART OF A COMPLETE SYSTEM.
2. A-C POWER SUPPLY USED CONNECTED TO 117 V A-C SOURCE.
3. VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH V.T.V.M.
4. RESISTANCE MEASUREMENTS TAKEN WITH TRANSMITTER COMPLETELY DISCONNECTED FROM RADIO SET.
5. VOLTAGE MEASUREMENTS WILL VARY SLIGHTLY DEPENDING UPON WHETHER 6, 12, OR 24V D-C POWER SUPPLY OR A-C POWER SUPPLY IS USED.
6. DO NOT MEASURE VOLTAGE ON V308, V309 OR V310 PLATE CAPS.

Figure 25. Radio Transmitters T-208/U and T-417/GR, tube socket voltage and resistance.

(3) Drill out the two rivets which fasten the socket to the chassis.

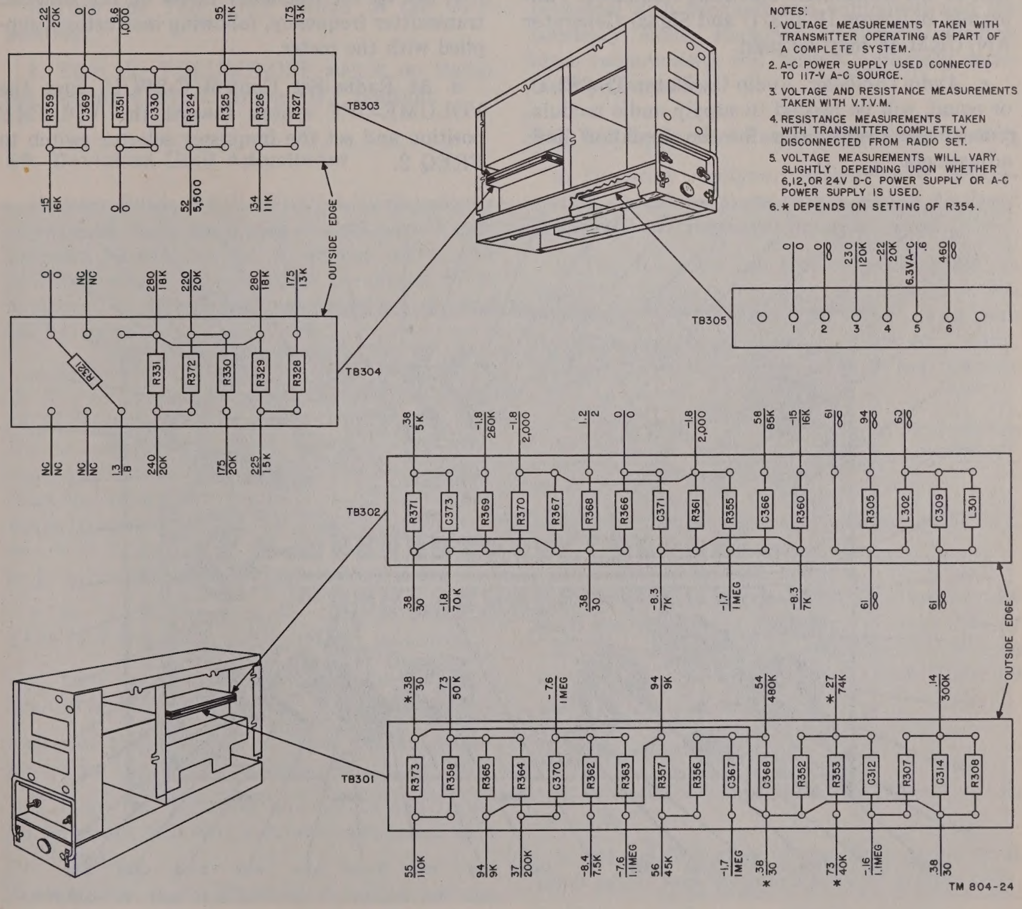
(4) Substitute a new socket and fasten it with rivets or machine screws, lockwashers, and nuts,.

(5) Resolder the wires to the socket.

(6) Clean the unit thoroughly to remove chips and solder drops.

(7) Check the new connections with those shown in the schematic for that unit.

b. Subminiature-type Tubes. To remove a subminiature-type tube, lift the hold-down clip away from the tube and then *very gently* lift the tube from its socket. The red dot on the side of the tube must be located next to the red dot painted on the chassis. Under the chassis, pin number 1 is the pin closest to a red dot painted directly on the chassis. The remaining pins are numbered as shown in figure 25. Replacement tubes are furnished with long leads attached, which must be cut to a length suitable for insertion in the tube socket. Carefully cut the leads with a sharp cutter.


TB303
-22/20K
0/0
8.6/1,000
95/11K
175/13K
R359
C369
R351
C330
R324
R325
R326
R327
-15/16K
0/0
52/5,500
134/11K
OUTSIDE EDGE
TB304
0/0
NC/NC
280/18K
220/20K
280/18K
175/13K
R321
R331
R372
R330
R329
R328
NC/NC
NC/NC
1.3/.8
240/20K
175/20K
225/15K
TB305
0/0
0/∞
230/120K
-22/20K
6.3VA-C/.6
460/∞
1
2
3
4
5
6
TB302
.38/5K
-1.8/260K
-1.8/2,000
1.2/2
0/0
-1.8/2,000
58/85K
-15/16K
61/∞
94/∞
63/∞
R371
C373
R369
R370
R367
R368
R366
C371
R361
R355
C366
R360
R305
L302
C309
L301
.38/30
-1.8/70K
.38/30
-8.3/7K
-1.7/1MEG
-8.3/7K
61/∞
61/∞
OUTSIDE EDGE
TB301
*.38/30
73/50K
-7.6/1MEG
94/9K
54/480K
*27/74K
.14/300K
R373
R358
R365
R364
C370
R362
R363
R357
R356
C367
C368
R352
R353
C312
R307
C314
R308
55/110K
94/9K
37/200K
-8.4/7.5K
-7.6/1.1MEG
56/45K
-1.7/1MEG
.38/30 *
73/40K *
-.16/1.1MEG
.38/30
TM 804-24

NOTES:
1. VOLTAGE MEASUREMENTS TAKEN WITH TRANSMITTER OPERATING AS PART OF A COMPLETE SYSTEM.
2. A-C POWER SUPPLY USED CONNECTED TO 117-V A-C SOURCE.
3. VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH V.T.V.M.
4. RESISTANCE MEASUREMENTS TAKEN WITH TRANSMITTER COMPLETELY DISCONNECTED FROM RADIO SET.
5. VOLTAGE MEASUREMENTS WILL VARY SLIGHTLY DEPENDING UPON WHETHER 6,12,OR 24V D-C POWER SUPPLY OR A-C POWER SUPPLY IS USED.
6. * DEPENDS ON SETTING OF R354.

Figure 26. Radio Transmitters T–208/U, and T–417/GR, terminal board voltage and resistance.

66. Refinishing

Instructions for refinishing badly marred panels are given in TM 9-2851.

Section III. ALINEMENT

67. Test Equipment Required for Alinement

a. Frequency Meter. Use Frequency Meter TS-174/U, or equal, to check the operating frequency of the transmitter.

b. Deviation Monitor. The deviation monitor used should be capable of indicating 15-kc deviation at the transmitter operating frequency. Panoramic Indicator IP-173/U and Signal Generator AN/URM-48 may be used.

c. Audio Oscillator. Audio Oscillator TS-382/U, or equal, will be needed to supply audio modulation to the transmitter for the deviation limit adjustment.

68. Crystal Frequency Adjustment

Variable capacitor C303 and C304 allow slight adjustment of the crystal operating frequency. These controls should be left in their center positions. Use a frequency standard meter comparable to the unit described in paragraph 67. To make adjustment perform the following steps.

a. Connect the transmitter to a proper noninductive load resistor.

b. Tune the transmitter as described in paragraph 19 and leave the TUNE-OPERATE switch in the TUNE position.

c. Set up the frequency meter on the assigned transmitter frequency, following instructions supplied with the meter.

d. At Radio Set Control C-847/U, turn the VOLUME-OFF switch toward the VOLUME position and set the frequency selector switch to FREQ 2.

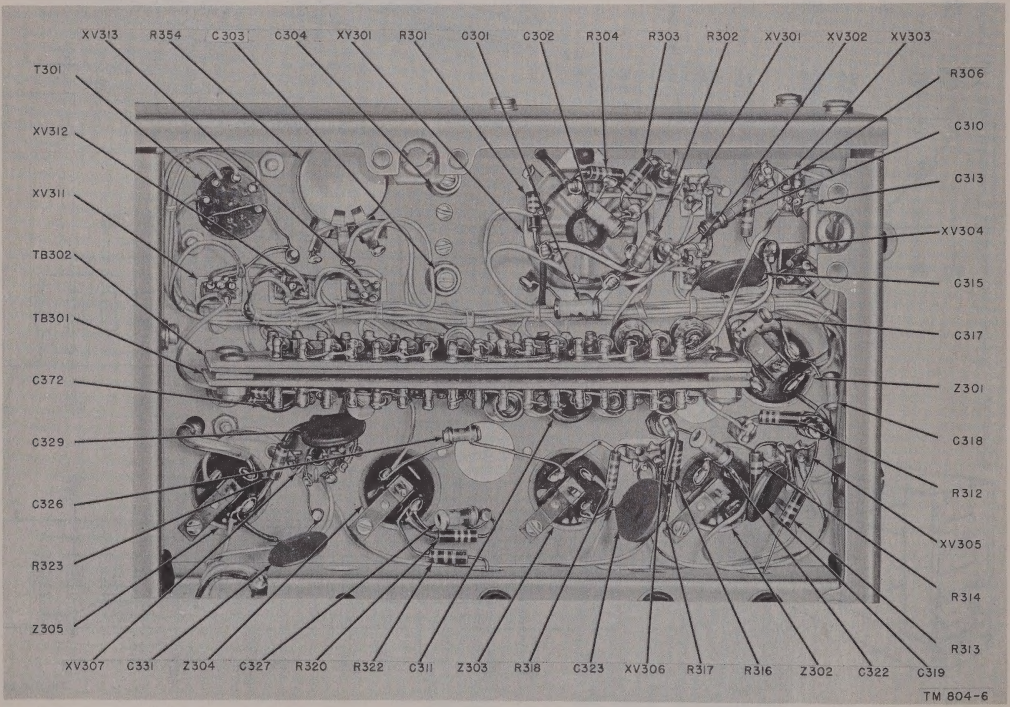

XV313
R354
C303
C304
XY301
R301
C301
C302
R304
R303
R302
XV301
XV302
XV303
T301
XV312
XV311
TB302
TB301
C372
C329
C326
R323
Z305
R306
C310
C313
XV304
C315
C317
Z301
C318
R312
XV305
R314
R313
XV307
C331
Z304
C327
R320
R322
C311
Z303
R318
C323
XV306
R317
R316
Z302
C322
C319
TM 804-6

Figure 27. Radio Transmitters T–208/U and T–417/GR, exciter subchassis, bottom view.

e. Turn the TEST-OFF switch on the transmitter to the TEST position.

f Adjust capacitor C303 (fig. 3) until the correct transmitter frequency is indicated on the frequency meter.

g. Set the frequency selector switch on Radio Set Control C-847/U to FREQ 1.

h. Set up the frequency meter to the desired transmitter frequency.

i. Adjust capacitor C304 (fig. 3) until the correct transmitter frequency is indicated on the frequency meter.

j. Turn the TEST-OFF switch to the OFF position.

k. Turn the VOLUME-OFF switch on Radio Set Control C-847/U to the OFF position.

69. Deviation Limit Adjustment

Resistor R354 (DEVIATION LEVEL) allows adjustment of the maximum deviation level. Adjustment should not be attempted unless the deviation monitor described in paragraph 67 is available. To make adjustments perform the following steps:

a. Set up the equipment as shown in A, figure 28. The audio oscillator connects to the 600-ohm audio input terminals of the transmitter. For Radio Transmitter T-208/U this connection is to terminals 9 and 10 of terminal board TB801 in Electrical Equipment Cabinet CY-938/VRC. For Radio Transmitter T-417/GR this connection is to terminals 5 and 10 of terminal board TB1902 in Electrical Equipment Cabinet CY-1221/G.

b. Set the frequency of the audio oscillator at 1,000 cycles and the input level at minimum.

c. Turn the VOLUME-OFF switch on Radio Set Control C-847/U to the VOLUME position.

d. Set the TEST-OFF switch on the transmitter to the TEST position.

e. Tune the deviation monitor to the transmitter signal, following instructions supplied with the monitor.

f. Observe the modulation deviation on the monitor and advance the audio oscillator level until no further increase in deviation is produced with an increase in audio level.

g. Adjust the DEVIATION LEVEL control R354 (fig. 3) on the transmitter for a deviation of 15 kc.

h. Turn the TEST-OFF switch on the transmitter to the OFF position.

Section IV. FINAL TESTING

70. General

This section is intended as a guide to be used in determining the quality of a repaired Radio Transmitter T-208/U or T-417/GR. The minimum test requirements outlined in paragraphs 72 through 75 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

71. Test Equipment Required for Final Testing

a. Distortion Analyzer. Measurements for distortion should be made with a Sound Analyzer TS-615/U, or an equivalent unit.

b. Test Receiver. The test receiver should be capable of tuning to 36.5 mc. The audio distortion introduced by this test receiver should be no more than 4 percent at the audio level used for testing. The frequency response curve of the receiver must be known.

c. Audio Voltmeter. Two audio voltmeters are required. These should be Multimeters TS-352/U, or equivalent.

d. Deviation Monitor. Refer to paragraph 67*b*.

e. Audio Oscillator. Refer to paragraph 67*c*.

f. R-f Wattmeter. The r-f wattmeter used should be Radio Frequency Wattmeter TS-118/AP, or equivalent. Power output measurements will be approximately 30 watts for the T-208/U and 50 watts for the T-417/GR.

72. Deviation Limit Check

a. Connect the equipment as shown in A, figure 28.

b. Set the frequency of the audio oscillator at 1,000 cycles and the input level at 5 volts.

c. Operate the transmitter and observe the modulation deviation on the monitor. The deviation should not exceed 15 kc.

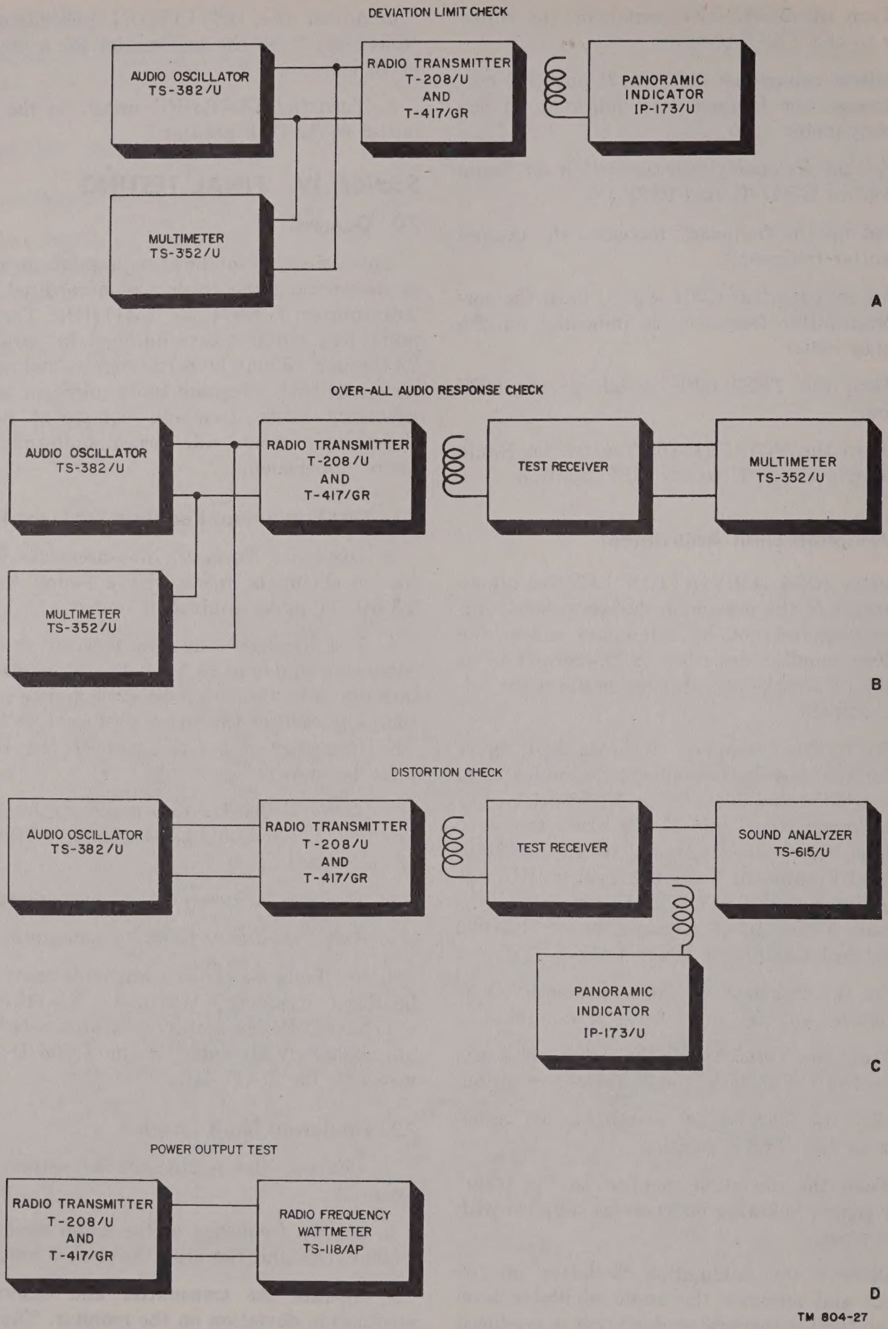

DEVIATION LIMIT CHECK
AUDIO OSCILLATOR TS-382/U
RADIO TRANSMITTER T-208/U AND T-417/GR
PANORAMIC INDICATOR IP-173/U
MULTIMETER TS-352/U
A
OVER-ALL AUDIO RESPONSE CHECK
AUDIO OSCILLATOR TS-382/U
RADIO TRANSMITTER T-208/U AND T-417/GR
TEST RECEIVER
MULTIMETER TS-352/U
MULTIMETER TS-352/U
B
DISTORTION CHECK
AUDIO OSCILLATOR TS-382/U
RADIO TRANSMITTER T-208/U AND T-417/GR
TEST RECEIVER
SOUND ANALYZER TS-615/U
PANORAMIC INDICATOR IP-173/U
C
POWER OUTPUT TEST
RADIO TRANSMITTER T-208/U AND T-417/GR
RADIO FREQUENCY WATTMETER TS-118/AP
D
TM 804-27

Figure 28. Radio Transmitters T–208/U and T–417/GR, test block diagram.

73. Over-all Audio Response Check

a. Connect the equipment as shown in B, figure 28. The audio oscillator is connected as described in paragraph 69*a*.

b. Adjust the audio input to 40 mv at 1,000 cycles.

c. With the transmitter operating on 36.5 mc, adjust the test receiver to the transmitter frequency.

d. Record the voltage at the audio output of the test receiver.

e. Repeat this measurement at 100, 200, 400, 2,000, and 3,500 cycles, holding the audio input to the transmitter constant at 40 mv.

f. Make corrections for the test receiver frequency response (including correction for a 6-db rising characteristic if this compensation is not incorporated in the test receiver).

g. The response at 100 cycles should not depart from that at 1,000 cycles by more than ±1 db. The response at 3,500 cycles should not be down more than 4 db.

74. Distortion Check

a. Set up the equipment as shown in C, figure 28. The distortion analyzer is connected across the test receiver audio output terminals.

b. Set the frequency of the audio oscillator at 800 cycles.

c. With the transmitter operating at 36.5 mc, adjust the test receiver to the transmitter frequency.

d. Adjust the audio oscillator input level into the transmitter to give an indication of 12-kc deviation on the deviation monitor.

e. Measure the distortion at the test receiver output, as indicated by the distortion analyzer. This value should not exceed 10 percent.

f. Repeat the distortion measurement at frequencies of 2,000 and 3,500 cycles, holding the transmitter deviation constant at 12 kc. Distortion should not exceed 10 percent.

75. Power Output Test

a. Tune Radio Transmitter T-208/U, as outlined in paragraphs 18 and 19, for an operating frequency of 25 mc.

b. Connect the antenna terminal (terminal A2 on Electrical Equipment Cabinet CY-938/VRC) to an r-f wattmeter D, figure 28.

c. Operate the transmitter and observe the power output indicated on the wattmeter. This should be at least 25 watts.

Note. Power output when operating at frequencies above 40 mc may be as low as 20 watts. The power output for Radio Transmitter T–417/GR may be as low as 40 watts.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

76. Disassembly

Radio Transmitter T-208/U and T-417/GR are plug-in units normally stored and transported in Electrical Equipment Cabinet CY-938/VRC or Electrical Equipment Cabinet CY-1221/G. To separate the transmitter from the system in which it operates, it is necessary only to remove it from the system cabinet unit.

77. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Normally, the transmitter will be housed in the cabinet for storage.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the inner carton. Protect the transit case with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected case in a padded wooden case, providing at least 3 inches of excelsior padding between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIAL TO PREVENT ENEMY USE

78. General

The demolition procedure outlined in paragraph 79 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

79. Methods of Destruction

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, and transformers, using sledges, axes, handaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut cords and wiring, using axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinet, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy. Destroy everything.

APPENDIX I

REFERENCES

Note. **For availability of items listed, check SR 310–20–3, SR 310–20–4, and SR 310–20–5. Check Department of the Army Supply Catalog SIG 1 for Signal Corps Supply Catalog pamphlets.**

1. Army Regulations

AR 380–5	Military Security (Safeguarding Military Information).
AR 750–5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Bulletins

SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.

3. Auxiliary Equipment and Test Equipment

NAVSHIPS 91, 272	Oscilloscope OS–8A/U.
TM 11–2627–2	Tube Test Data.
TM 11–1257	Signal Generator AN/URM–48.
TM 11–2627	Tube Tester I–177 andI–177–A
TM 11–2684	Audio Oscillators TS–312/FMS–1 and TS–382/U.
TM 11–4700	Electrical Indicating and Measuring Instruments: Repair Instructions.
TM 11–5527	Multimeter TS–352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage, Decontamination, and Demolition

FM 5–20	Camouflage, Basic Principles.
FM 5–25	Explosives and Demolitions.
FM 3–220	Decontamination.

6. Other Publications

FM 24–18	Field Radio Techniques.
SR 310–20–3	Index of Training Publications.
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310–20–5	Index of Administrative Publications.

SR 700–45–5	Unsatisfactory Equipment Report. (Reports Control Symbol CSGLD–247).
SR 745–45–5 NAV DEPT SERIAL 85P00 AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), SandA–70–6 (Navy), and AF–MC–U2 (Air Force)).
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 54	Working through Jamming with Frequency Modulated Radio Sets.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–314	Antennas and Antenna System.
TM 11–430	Batteries for Signal Communication, Except those pertaining to Aircraft.
TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–661	Electrical Fundamentals (Direct Current).
TM 11–662	Theory and Application of Electron Tubes.
TM 11–681	Electrical Fundamentals (Alternating Current).
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7&8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7&8 Radio Transmitter T–208/U and T–417/GR. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RADIO TRANSMITTER T–208/U: 25 to 50 mc; crystal controlled; 30 w; dc, 380 v, .180 amp; 275 v, .016 amp; 225 v, .045 amp; 90 v, .004 amp; 24 v, .25 amp; 6.3 v, 2 amp; 6 v, .30 amp; 6v, .9 amp; 2 v, .01 amp; 1.3 v, .100 amp; 1.25 v, .9 amp; 1.25 v, .20 amp; –25 v, .005 amp; 14½″ lg x 4½″ wd x 8$\frac{9}{16}$″ h.	Radio Transmitter for Radio Sets AN/VRC–6, –6X, and –6Y.	
	RADIO TRANSMITTER T–417/GR: 25 to 50 mc; crystal controlled; 50 w; dc, 460 v, .180 amp; 275 v, .016 amp; 225 v, .045 amp; 90 v, .004 amp; 24 v, .25 amp; 6.3 v, 2 amp; 6 v, .30 amp; 6 v, .9 amp; 2 v, .01 amp; 1.3 v, .100 amp; 1.25 v, .9 amp; 1.25 v, .20 amp; –25 v, .005 amp; 14½″ lg x 4½″ wd x 8$\frac{9}{16}$″ h.	Radio Transmitter for Radio Sets AN/FRC–15 and AN/TRC-22.	
C301, C302	CAPACITOR, fixed: ceramic; 75 uuf ±5%; 500 vdcw.	C301: V302 screen grid r-f bypass. C302: V301 screen grid r-f bypass.	3D9075–33
C307, C308, C331	CAPACITOR, fixed: ceramic; 10,000 uuf +100%–0; 500 vdcw	C307: V302 filament bypass. C308: V301 filament bypass. C331: V307 screen grid bypass.	3DA10–562
C309	CAPACITOR, fixed; ceramic; 27 uuf ±5%; 500 vdcw.	L301 r-f bypass.	3D9027-58
C310	CAPACITOR, fixed: ceramic; 10uuf ±10%;.500 vdcw.	V303 control grid balancing.	3D9010–231
C313, C322, C327	CAPACITOR, fixed: ceramic; 100 uuf ±20%; 500 vdcw.	C313: V304 control grid coupling. C322: V306 control grid coupling. C327: V307 grid return bypass.	3D9100–339

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C315, C319, C323, C329, C339, C340, C347, C349, C350, C351	CAPACITOR, fixed: ceramic; 10,000 uuf each section +100%–0; 500 vdcw.	C315: V304 screen grid bypass. C319: V305 screen grid bypass. C323: V306 screen grid bypass. C329: V307 cathode and screen grid bypass. C339: V308 cathode and filament bypass. C340: V308 cathode and screen grid bypass. C347: V310 cathode and filament bypass. C349: V309 cathode and filament bypass. C350: V309 cathode and screen grid bypass. C351: V310 cathode and screen grid bypass.	3DA10–624
C317	CAPACITOR, fixed: ceramic; 39 uuf ±5%; 500 vdcw.	L303 r-f bypass.	3D9039–54
C318	CAPACITOR, fixed: ceramic; 47 uuf ±20%; 500 vdcw.	V305 control grid coupling.	3D9047–77
C321	CAPACITOR, fixed: ceramic; 15 uuf ±5%; 500 vdcw.	Part of Z302 network.	3D9015–157
C325	CAPACITOR, fixed: ceramic; 12 uuf ±5%; 500 vdcw.	Part of Z303 network.	3D9012–87
C326	CAPACITOR, fixed: ceramic; 1.5 uuf ±.25 uuf; 500 vdcw.	V307 grid coupling.	3D9001E5–21
C328	CAPACITOR, fixed: ceramic; 10 uuf ±.5 uuf; 500 vdcw.	Part of Z304 network.	3D9010–230
C332	CAPACITOR, fixed: ceramic; 5 uuf ±.25 uuf; 500 vdcw.	Part of Z305 network.	3D9005–113
C333	CAPACITOR, fixed: ceramic; 51 uuf ±5%; 500 vdcw.	Part of Z305 network.	3D9051–53
C335, C344, C348, C352	CAPACITOR, fixed: ceramic; 1500 uuf ±20%; 750 vdcw.	C335: J304 bypass. C344: V308 plate bypass. C348: V308, V309, and V310 filament bypass. C352: V309 and V310 plate bypass.	3DA1–370
C338, C341	CAPACITOR, fixed: ceramic; 1000 uuf +80% –20%, 500 vdcw.	C338: V308 grid bias voltage bypass. C341: V308 screen grid bypass.	3DA1–372
C360, C364	CAPACITOR, fixed: ceramic; 39 uuf ±5%; 500 vdcw.	C360, C364: Antenna filters.	3D9039–53
C361, C365	CAPACITOR, fixed: ceramic; 24 uuf ±5%; 500 vdcw.	C361, C365: Antenna filters.	3D9024–66
C362	CAPACITOR, fixed: ceramic; 120 uuf ±5%; 500 vdcw.	Antenna filter.	3D9120–49
C363	CAPACITOR, fixed: ceramic; 75 uuf ±5%; 500 vdcw.	Antenna filter.	3D9075–63

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C330, C371	CAPACITOR, fixed; electrolytic; 1 sect.; 8 uf; 30 vdcw.	C330: +2 v line decoupling filter. C371: −22 volt line decoupling filter.	3DB8–240
C334	CAPACITOR, fixed: electrolytic; 2 sect.; 30 uf per section; 400 vdcw.	200 v B+ line filter.	3DB30–58
C369	CAPACITOR, fixed: electrolytic; 4uf; 60 vdcw.	−22 v line filter.	3DB4–412
C336, C346	CAPACITOR, fixed: mica; 500 uuf ±10%; 500 vdcw.	C336: V308 grid coupling. C346: V309 and V310 grid coupling.	3K2051111
C342, C353	CAPACITOR, fixed: mica; 1500 uuf ±10%; 500 vdcw.	C342: Part of V308 plate loading network. C353: Part of V309 and V310 plate tuning network.	3K3015221
C356, C357, C358, C359	CAPACITOR, fixed: mica; 100 uuf ±10%; 500 vdcw.	C356 thru C359: Part of S303 coupling switch network.	3D9100–295
C366	CAPACITOR, fixed: mica; 250 uuf ±5%; 500 vdcw.	V313 feedback plate to grid.	3D9250–129
C373	CAPACITOR, fixed: mica; 510 uuf ±5%; 300 vdcw.	V311 control grid d-c blocking.	3D9510–38
C311, C372	CAPACITOR, fixed: paper; 100,000 uuf ±20%; 200 vdcw.	C311: V303 control grid bypass. C372: V311 plate and screen decoupling.	3DA100–1172
C312, C314, C367, C368, C370	CAPACITOR, fixed: paper; 10,000 uuf ±20%; 200 vdcw.	C312: Couples plate of V313 to control grid of V303. C314: Bypass for R308. C367: Couples plate of V312 to control grid of V313. C368: Part of differentiating network in plate circuit of V312. C370: Couples plate of V311 to control grid of V312.	3DA10–625
C303, C304	CAPACITOR, variable: air; 75 uuf max, 6.5 uuf min; 600 v rms peak; $1\frac{1}{2}$″ lg x $\frac{15}{16}$″ wd x $1\frac{7}{32}$″ h.	C303: V302 oscillator control. C304: V301 oscillator control.	3D9075V–33
C337, C345	CAPACITOR, variable: air; 99 uuf max, 7.5 uuf min.	C337, C345: Control grid tuning for V308.	3D9099V–4
C343	CAPACITOR, variable: air; 99 uuf max, 7.5 uuf min; 600 v peak.	V308 plate tuning.	3D9099V–7
C354	CAPACITOR, variable: air; 75 uuf max, 6.5 uuf min; 1200 v peak.	Plate tuning for V309 and V310.	3D9075V–50

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C355	CAPACITOR, variable: air; 143 uuf max, 9 uuf min; 600 v peak.	Antenna coupling control.	3D9143V-2
H301, H371, H372	CLAMP, electrical: ethyl cellulose acetate; 1″ lg x 1″ wd x 7/16″ h.	H301, H371, H372: Cable clamps.	8P1-101-2
H345, H346	CLAMP, electrical: ethyl cellulose acetate; 13/16″ lg x 1/2″ wd x 5/16″ h.	H345, H346: Cable clamps.	8P1-101-1
E304, E305, E306	CLIP, electrical: spring brass; 15/16″ lg x 7/16″ wd x 3/8″ h.	E304: Plate connector for driver tube V308. E305: Plate connector for driver tube V309. E306: Plate connector for driver tube V310.	2Z2712.295
H361 thru H369	CLIP, electrical: steel and brass; 1 11/32″ lg, 5/8″ wd o/a, 5/32″ thk.	H361 thru H369: Hold tube in place.	2Z2712.381
L301, L302	COIL, RF: 6 mh at .25 mc, 435 ohms dc; 690 turns, #38 AWG, copper cond; .625″ lg x .198″ dia.	L301: Plate load for V303. L302: Plate load for crystal oscillator tubes.	3C1084B-107
L308	COIL, RF: 1.48 uh at 7.9 mc, .0132 ohms dc; 16 turns, #18 AWG, copper cond; 1 1/2″ lg x 1/2″ dia.	V308 grid tuning coil.	3C1084B-108
L311, L318	COIL, RF: 21 uh at 2.5 mc, 2.496 ohms dc; 115 turns, #34 AWG, copper cond; 2.375″ lg x .312″ dia.	L311: Driver plate decoupling coil. L318: Power amplifier plate decoupling coil.	3C1084B-109
L312	COIL, RF: .500 uh at 25 mc, .003 ohms dc; 7 1/2 turns, #14 AWG, copper cond; 1 1/2″ lg x 1/2″ dia.	Driver plate tune coil.	3C1084B-110
L313	COIL, RF: .465 uh at 25 mc, .003 ohms dc; 7 1/2 turns, #14 AWG, copper cond; 1 1/2″ lg x 1/2″ dia.	Power amplifier grid tune coil.	3C1084B-111
L316	COIL, RF: 5 turns, #12 AWG, copper cond; 2 3/16″ lg x 5/8″ wd x 3/32″ thk.	V309 and V310 plate coil for 40 to 50 mc.	3C1084B-112
L317	COIL, RF: 6 turns, #12 AWG, copper cond; 2 3/16″ lg x 5/8″ wd x 3/32″ thk.	V309 and V310 plate coil for 32 to 40 mc.	3C1084B-113
L319	COIL, RF: 9 turns, #12 AWG, copper cond; 2 3/16″ lg x 5/8″ wd x 3/32″ thk.	V309 and V310 plate coil for 25 to 32 mc.	3C1084B-114
L320, L323	COIL, RF: 6 turns, #18 AWG, copper cond.	L320, L323: Antenna filter coils.	3C1084B-115
L321, L322	COIL, RF: 9 turns, #18 AWG, copper cond.	L321, L322: Antenna filter coils.	3C1084B-116
Z301	COIL, RF: 52 uh at 2.5 mc, 8.65 ohms dc; 2 5/32″ lg x 1/4″ dia; contains one RC10BF103K resistor.	Plate load for V304.	3C1084B-117
Z302	COIL, RF: 22.6 uh at 2.5 mc, 3.9 ohms dc; 2 5/32″ lg x 1/4″ dia; contains one CC20PH150J capacitor and one RC10BF103K resistor.	Plate load for V305.	3C1084B-118

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
Z303	COIL, RF: 8.2 uh at 7.9 mc, 2.17 ohms dc; $2\frac{5}{32}''$ lg x $\frac{1}{4}''$ dia; contains one CC20PH120J capacitor and one RC10BF472K resistor.	Plate load for V306.	3C1084B–119
Z304	COIL, RF: 8.2 uh at 7.9 mc, 2.17 ohms dc; contains one CC20PH100D capacitor; $2\frac{5}{32}''$ lg x $\frac{1}{4}''$ dia.	Tunes V307 control grid.	3C1084B–120
Z305	COIL, RF: 2.85 uh at 7.9 mc, .257 ohms dc; $2\frac{5}{32}''$ lg x $\frac{1}{4}''$ dia; contains one CC20SL510J capacitor and one CC20PH050C capacitor.	Plate load for V307.	3C1084B–121
E337, E338	CONNECTOR, plug: one male rd; $\frac{39}{64}''$ lg x $\frac{21}{64}''$ dia; 50 ohms nom impedance.	E337, E338: Coaxial connectors.	2Z7390–88
J301, J302, J303	CONNECTOR, receptacle: 1 female rd.	J301: Test point for control grid of V305. J302: Test point for control grid of V306. J303: Test point for control grid of V307.	2Z3055–38
P301	CONNECTOR, receptacle: 32 male rd; pol; $1\frac{7}{32}''$ lg, excluding protruding cont; $3\frac{3}{8}''$ wd x $1\frac{11}{16}''$ h; 28-10 amp, 2-40 amp, 2 coaxial-2 amp, 110 v ac.	Connects transmitter to cabinet.	2Z3046.40
O301, O302, O303	COUPLING: sleeve type; $\frac{1}{4}''$ opening ea end; 4 setscrew mtg; $\frac{3}{4}''$ lg x $\frac{1}{2}''$ dia o/a; brass, nickel pl.	O301: Couples extension shaft to C343. O302: Couples extension shaft to C354. O303: Couples extension shaft to C355.	2Z8203–752
V301, V302, V303	ELECTRON TUBE: pentode; type 1AD4.	V301: First oscillator. V302: Second oscillator. V303: Modulator.	2J1AD4
V304, V305, V311, V313	ELECTRON TUBE: pentode; type 5678.	V304: Buffer. V305: First doubler. V311: First audio amplifier. V313: Second audio amplifier.	2J5678
V306, V312	ELECTRON TUBE: pentode; type 5672.	V306: Second doubler. V312: Limiter.	2J5672
V307	ELECTRON TUBE: pentode; type 3B4.	Third doubler.	2J3B4
V308	ELECTRON TUBE: pentode; type 2E26.	R-f driver in T–417/GR.	2J2E26
V308	ELECTRON TUBE: pentode; type 2E24.	R-f driver in T–208/U.	2J2E24
V309	ELECTRON TUBE: pentode; type 6146.	R-f amplifier in T–417/GR.	2J6146
V309	ELECTRON TUBE: pentode; type 2E24.	R-f power amplifier in T–208/U.	2J2E24
V310	ELECTRON TUBE: pentode; type 6146.	R-f amplifier in T–417/GR.	2J6146

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
V310	ELECTRON TUBE: pentode; type 2E24.	R-f power amplifier in T-208/U.	2J2E24
E318, E319, E321	INSULATOR, washer: neoprene; black; round, flat disk shape; .500″ dia x .188″ hole x .032″ thk o/a.	E318 thru E321: Insulating washers.	3G385–160
A311	MOUNTING, bracket: aluminum alloy; U-shape; 4.110″ lg x 1.500″ wd x .564″ thk, approx o/a.	Mounting bracket for test point board and switches.	2Z6820.603
E301	OVEN, crystal: two crystal units; 75° C oven temp; −40° C ambient temp, ±5° C; 6.3 v ac or 24.2 v ac, 60 cyc, single ph, 6 w; aluminum case; 1.687″ h x 1.25″ dia excl terms.	Constant temperature crystal oven.	2Z6897–7
HR301	OVEN, crystal: two crystal units; 75° C oven temp, −40° ambient temp, ±5° C; 6.3 v ac or 24.2 v ac, 60 cyc, single ph, 6 w; bakelite case; 1.281″ h x 1.175″ dia excl terms.	Crystal oven heater.	
A312	PANEL: aluminum; rectangular shape; 4 1/16″ lg x 1/2″ wd x 5 5/8″ h, approx o/a.	Front panel.	2Z6900–73
K301	RELAY, solenoid: normally closed, single break, dc, 115 v, 2 amp; one noninductive wnd, dc, 52 ohms resistance, 6 v dc, 111 ma; intermittent duty; 2 15/16″ lg x 2 3/8″ wd x 1 1/4″ h o/a.	Antenna relay.	2Z7599A–450
R305	RESISTOR, fixed: comp; 4700 ohms ±10%; 1/2 w.	+90-volt dropping.	3RC20BF472K
R306, R364	RESISTOR, fixed: comp; 150,000 ohms ±10%; 1/2 w.	R306: V303 control grid limiting. R364: V311 plate voltage-dropping resistor.	3RC20BF154K
R307, R309, R312, R313, R316, R317, R322, R332, R338, R355, R362	RESISTOR, fixed: comp; 1 meg ±10%; 1/2 w.	R307: V303 control grid limiting. R309: V304 control grid limiting. R312: V305 control grid limiting. R313: J301 voltage dropping. R316: V306 control grid limiting. R317: J302 voltage dropping. R322: J303 voltage dropping. R332: J304 voltage dropping. R338: J305 voltage dropping. R355: V313 control grid limiting. R362: V312 control grid limiting.	3RC20BF105K
R308	RESISTOR, fixed: comp; 330,000 ohms ±10%; 1/2 w.	B+ 90-volt dropping.	3RC20BF334K

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R310, R356, R301, R304, R374	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w.	R310: V304 screen grid voltage limiting. R356: V312 to V313 coupling. R301: V302 control grid voltage dropping. R304: V301 control grid voltage dropping. R374: Part of V311 screen grid voltage divider network.	3RC20BF474K
R311, R315	RESISTOR, fixed: comp; 10,000 ohms ±10%; ¼ w.	R311: Part of network Z301. R315: Part of network Z302.	3RC10BF103K
R318, R302, R303	RESISTOR, fixed: comp; 22,000 ohms ±10%; ½ w.	R318: V306 screen grid dropping. R302: V302 control grid limiting. R303: V301 control grid limiting.	3RC20BF223K
R319	RESISTOR, fixed: comp; 4700 ohms ±10%; ¼ w.	Part of network Z303.	3RC10BF472K
R323, R365	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w.	R323: V307 screen grid dropping. R365: V311 plate dropping.	3RC20BF473K
R324, R325	RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w.	Parts of B+ filter and voltage dropping network.	3RC42BF472K
R326, R327, R330, R331	RESISTOR, fixed: comp; 1500 ohms ±10%; 2 w.	R326, R327: Parts of B+ filter and voltage-dropping network. R330, R331: V307 plate and screen voltage-dropping resistors.	3RC42BF152K
R333, R373	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w.	R333: V308 control grid bias limiting. R373: R-f output voltage bleeder.	3RC30BF104K
R334, R341, R342	RESISTOR, fixed: comp; 10 ohms ±10%; 1 w.	R334: V308 control grid input limiting. R341: V310 control grid input limiting. R342: V309 control grid input limiting.	3RC30BF100K
R328, R329, R367	RESISTOR, fixed: comp; 2200 ohms ±10%; 2 w.	R328, R329: Parts of B+ filter and voltage dropping network. R367: Part of voltage divider network for V311, V312, and V313 cathodes.	3RC42BE222K

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R314, R320, R358	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w.	R314: V305 screen grid dropping. R320: V307 control grid leak. R358: Part of V311 screen and voltage divider network.	3RC20BF104K
R335	RESISTOR, fixed: comp; 100 ohms ±10%; 1 w.	V308 filament balancing resistor.	3RC30BF101K
R344, R345	RESISTOR, fixed: comp; 47 ohms ±10%; 1 w.	R344, R345: Filament and cathode balancing resistors for V309 and V310.	3RC30BF470K
R337,	RESISTOR, fixed: comp; 6,800 ohms ±10%; 1 w.	V308 screen grid voltage dropping.	3RC30BF682K
R339	RESISTOR, fixed: comp; 10,000 ohms ±10%; 2 w.	V309 and V310 control grid bias limiting.	3RC42BF103K
R346, R347	RESISTOR, fixed: comp; 2200 ohms ±10%; 1 w.	R346: V310 screen grid voltage-dropping resistor. R347: V309 screen grid voltage-dropping resistor.	3RC30BF222K
R348	RESISTOR, fixed: comp; 10 ohms ±5%; 1 w.	J306 and J307 shunt resistor.	3RC30BF100J
R349	RESISTOR, fixed: comp; 47,000 ohms ±10%; 2 w.	Switch S302 tune position bleeder.	3RC42BF473K
R350	RESISTOR, fixed: comp; 68,000 ohms ±10%; 1 w.	Switch S302 shunt resistor.	3RC30BF683K
R351	RESISTOR, fixed: comp; 1000 ohms ±10%; 1 w.	+2-volt dropping resistor.	3RC30BF102K
R353, R363, R369	RESISTOR, fixed: comp; 220,000 ohms ±10%; ½ w.	R353: Deviation level limiting. R363: V312 control grid input limiting. R369: V311 control grid limiting.	3RC20BF224K
R357	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w.	V312 plate load.	3RC20BF333K
R359, R360, R361	RESISTOR, fixed: comp; 6800 ohms ±10%; ½ w.	R351: Part of −22-volt bias filter network. R360, R361: Parts of audio section bias filter network.	3RC20BF682K
R366	RESISTOR, fixed: comp; 47 ohms ±10%; ½ w.	Part of voltage divider network for V311, V312, and V313 cathodes.	3RC20BF470K
R368	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w.	Part of voltage divider network for V311, V312, and V313 cathodes.	3RC20BF101K

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R370, R371	RESISTOR, fixed: comp; 68,000 ohms ±10%; ½ w.	R370: V311 control grid limiting. R371: Shunt across secondary of T301.	3RC20BF683K
R372	RESISTOR, fixed: comp; 1000 ohms ±10%; 2 w.	Part of V307 plate and screen grid voltage-dropping network.	3RC42BF102K
R354	RESISTOR, variable: comp; 100,000 ohms ±20%; ¼ w.	Modulation deviation level control.	3RV51057
R321	RESISTOR, WW: 3.6 ohms ±10%; 2 w.	1.25 filament voltage-dropping resistor.	3RU11601
H302, thru H305, H340 thru H344, H349, H350, H355 thru H360	RETAINER, fastener stud: steel, cad pl; 1″ lg x 33/64″ wd x 3/16″ thk o/a.	Retainers for cover fastener stud.	6Z7852–9
O304, O305, O306	SHAFT: plastic; 1″ lg x .253″ dia max o/a.	O304: Extension shaft for C343. O305: Extension shaft for C354. O306: Extension shaft for C355.	2Z8203–753
E310	SHELL, electrical connector: brass; cylindrical; .750″ lg x .250″ OD x .152″ and .204″ ID.	Conduit and grounding connection for r-f cable.	2Z8276–113
E302	SHIELD, electron tube: copper or brass; cylindrical; .930″ dia x 1¾″ h o/a.	Shield for V307.	2Z8304.276
XC334, XY301, XV308, XV309, XV310	SOCKET, electron tube: 8 cont; copper base, nonmagnetic alloy; medium; oval shape; 1⅞″ lg max x 1⅜″ wd max x 25/32″ h max o/a.	XC334: Holds capacitor C334. XY301: Holds crystal oven. XV308: Holds tube V308. XV309: Holds tube V309. XV310: Holds tube V310.	2Z8670.33
XV301 thru XV306, XV311, XV312, XV313	SOCKET, electron tube: 5 cont; submin.	XV301: Socket for first oscillator V301. XV302: Socket for second oscillator V302. XV303: Socket for modulator V303. XV304: Socket for buffer V304. XV305: Socket for first doubler V305.	2Z8675.107

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
XV306, XV311, XV312, XV313	SOCKET, electron tube: 5 cont; submin.	XV306: Socket for second doubler V306. XV311: Socket for first audio amplifier V311. XV312: Socket for limiter V312. XV313: Socket for second audio amplifier V313.	
XV307	SOCKET, electron tube: 7 cont; min.	Holds tube V307.	2Z8677.94
H370	STRAP, mounting: steel; 1 3/16″ lg x 15/16″ wd x 1 1/32″ d.	Transformer mounting strap.	2Z9052–121
H306 thru H309, H318 thru H321	STUD: steel; 33/64″ lg x 11/64″ dia o/a.	Airloc fastener studs.	6Z8585–14
H310, H311, H322, H323	STUD: steel; 33/64″ lg x 11/64″ dia.	Airloc fastener studs.	6Z8585–8
H330 thru H334	STUD: steel; 33/64″ lg x 11/64″ dia.	Airloc fastener studs.	6Z8585–10
H351, H352	STUD: steel; .516″ lg x .260″ dia.	Airloc fastener studs.	6Z8585–9
Z306	SUPPRESSOR, parasitic: resistor and coil type; 2 turns, #18 AWG coil wire; 47 ohms, 1 w; .750″ lg x .420″ dia o/a.	Parasitic suppressor V308 plate circuit.	3Z1891A–2.5
S303	SWITCH, rotary: 1 sect.; 5 positions; max 1 pole, 5 throws; 115 v ac, 60 cyc, .5 amp; 1 1/64″ lg x 1 5/8″ wd x 1 7/8″ h o/a.	Coupling switch.	3Z9825–23.18
S301, S302	SWITCH, toggle: SPDT; 2 amp; 250 v ac; 1 9/32″ lg max x 23/32″ wd max x 23/32″ h max o/a.	S301: TEST OFF switch. S302: TUNE-OPERATE switch.	3Z9863–12D
TB307	TERMINAL BOARD: T-shape; 2 1/4″ lg x 13/16″ wd x 9/16″ h o/a.	Test panel.	3Z770–6.160
TB301	TERMINAL BOARD: phenolic; 34 term.; 5 3/8″ lg x 1 1/2″ wd x 1/16″ thk o/a; marked, TB301, R308, C314, R307, C312, R353, R352, C368, C367, R356, R357, R363, R362, R370, C364, R365, R358, R370.	Terminal board.	3Z770–34.29
TB302	TERMINAL BOARD: phenolic; 34 term.; 5.375″ lg x 1.500″ wd x .062″ thk o/a; marked TB302, L301, C309, L302, R305, R360, C366, R355, R361, C371, R366, R368, R367, R370, R369, C373, R371.	Terminal board.	3Z770–34.28
TB303	TERMINAL BOARD: phenolic; 16 term.; 4″ lg x 1 15/16″ wd x 1/16″ thk o/a; marked R359, C369, R351, C330, R324, R325, R326, R327, TB303.	Terminal board.	3Z770–16.88

2. Identification Table of Parts for Radio Transmitters T-208/U and T-417/GR—(contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
TB304	**TERMINAL BOARD:** phenolic; 14 term.; 4″ lg x 1$\frac{15}{16}$″ wd x $\frac{1}{16}$″ thk o/a; marked R321, R331, R372, R330, R329, R328, TB304.	Terminal board.	3Z770–14.90
TB305	**TERMINAL BOARD:** plastic; 6 term.; 2$\frac{11}{16}$″ lg x $\frac{1}{2}$″ wd x 1″ d o/a; marked TB305 and terminals marked 1 thru 6.	Terminal board.	3Z770–6.160
TB306	**TERMINAL BOARD:** plastic; 10 term.; 2$\frac{1}{8}$″ lg x $\frac{27}{32}$″ wd x $\frac{1}{16}$″ thk o/a; marked TB306 and terminals numbered 1 thru 10.	Terminal board.	3Z770–10.103
E311, E312, E313	**TERMINAL,** stud: 22,000 v break-down; turret type; mineral filled phenolic body w/brass term. and insert; terminal $\frac{7}{8}$″ lg x $\frac{1}{4}$″ wd o/a.	Tie points.	3Z12101–9.11
E314, E328	**TERMINAL,** stud: 14,000 v break-down; brass w/phenolic base; $\frac{9}{16}$″ lg x $\frac{1}{4}$″ dia.	E314: Tie point. E328: Mounting terminal.	3Z12101–9.5
E322 thru E327	**TERMINAL,** stud: 14,000 v break-down; molded asbestos filled melamine, brass stud and term.; $\frac{5}{8}$″ lg x $\frac{1}{4}$″ dia.	Mounting terminals.	3Z12101–45.1
T301	**TRANSFORMER, AF:** 600 ohms pri w/150 ohms tap, 60,000 ohms secd; 10 ma dc pri cur; 500 v test; 1$\frac{1}{4}$″ lg x $\frac{15}{16}$″ dia o/a; ±2 db 300 to 3500 cyc.	Microphone input transformer.	2Z9631.488
	WRENCH: Allen type setscrew wrench; o/a dim 1.8″ lg x .55″ h x .05″ across flats; for #4 Allen setscrew.	Hexagon socket head setscrew wrench.	
	WRENCH: Allen type setscrew wrench; o/a dim 1$\frac{29}{32}$″ lg x $\frac{23}{32}$″ h x $\frac{1}{16}$″ across flats; for #6 Allen setscrew.	Hexagon socket head setscrew wrench.	
	WRENCH: Allen type setscrew wrench; o/a dim 2.047″ lg x .781″ h x .078″ across flats; for #8 Allen setscrew.	Hexagon socket head setscrew wrench.	
	WRENCH: Allen type setscrew wrench; o/a dim 2$\frac{3}{16}$″ lg x $\frac{27}{32}$″ h x $\frac{3}{32}$″ across flats; for #10 Allen setscrew.	Hexagon socket head setscrew wrench.	
	WRENCH: Allen type setscrew wrench; o/a dim 2$\frac{15}{32}$″ lg x $\frac{31}{32}$″ h x $\frac{1}{8}$″ across flats; for $\frac{1}{4}$″ Allen setscrew.	Hexagon socket head setscrew wrench.	

INDEX

Paragraph *Page*

A

Additional equipment required . . . 9 5
Adjustment:
  Crystal frequency . . . 68 46
  Deviation limit . . . 69 47
Alinement:
  Crystal frequency adjustment . . . 68 46
  Deviation limit adjustment . . . 69 47
  Test equipment required . . . 67 68
  Tools . . . 30 16
Audio response, final test . . . 73 49

B

B+ circuit, checking for shorts . . . 60 40
B+ distribution . . . 52 33
Block diagram for Radio Transmitters T–208/U and T–417/GR . . . 43 25
Buffer . . . 46 27

C

Checking B+ circuit for shorts . . . 60 40
Component sectionalization and localization . . . 56*b* 38
Connections . . . 13 7
Control circuits . . . 54 33
Controls:
  Radio Set Control C–847/U . . . 17 9
  Radio Transmitters T–208/U and T–417/GR . . . 16 8
Crystal frequency:
  Adjustment . . . 68 46
  Relation to operating frequency . . . 44*b* 26
Crystal oscillator, theory . . . 44 26
Crystal oven, disassembly . . . 18*f* 11
Crystals:
  Determining frequency . . . 18*e* 10
  Installation . . . 18*f* 11

D

Data, trouble-shooting . . . 57 30
Demolition of material to prevent enemy use . . . 78 50
Description of transmitter . . . 7 4
Destruction, methods of . . . 79 50
Deviation:
  Final test . . . 72 47
  Limit adjustment . . . 69 47

	Paragraph	Page
D (contd)		
Difference in models	10	6
Disassembly	76	50
Distortion, check	74	49
Doublers	47	28
Dual frequency, choice	22	14
E		
Equipment performance checklist	41	22
Export shipment, uncrating and unpacking	6	4
F		
Field maintenance level trouble shooting	56	38
Fifth doubler and driver, theory	47	28
Filament voltage distribution	53	33
Final Testing:		
Deviation limit check	72	47
Distortion	74	49
Over-all audio response	73	49
Power output	75	49
Test equipment required	71	47
First audio amplifier, theory	49	32
First doubler, theory	47	28
Forms and Records:		
Operator first echelon maintenance checklist for Signal Corps equipment	2*d*	1
Report of damaged or improper shipment	2*a*	1
Second and third echelon maintenance checklist for Signal Corps equipment	2*e*	1
Unsatisfactory equipment report	2*b*	1
Forms and Records—(contd)		
Unsatisfactory report	2*c*	1
Use of preventive maintenance forms	33	17
Fourth doubler, theory	47	47
Frequencies, dual operating	22	14
Frequency, adjustment	68	46
Frequency, changing	22	14
Frequency multiplication	47	28
I		
Identification table of parts	APP. II	53
Installation	13	7
L		
Limiter, theory	50	32
Lubrication:		
Precautions	37*c*	21
Requirements	36	21
M		
Maintenance:		
Desert	37*d*	21
Preventive	31	17
Tropical	37*b*	21

M (contd)

	Paragraph	Page
Trouble shooting	56	38
Winter	37*c*	21
Measurement of resistance	60	40
Multiplication, frequency	47	28

N

	Paragraph	Page
Nomenclature, official	1	1

O

	Paragraph	Page
Operating frequency, selection of	22	14
Operation:		
Arctic climates	25	14
Desert climates	27	15
Frequency changing	22	14
Preliminary adjustment	18	9
Preliminary starting	20	14
Starting	21	14
Stopping	23	14
Tropical climates	26	14
Tuning	19	12
Operational test	97	61
Organizational maintenance:		
Procedures:		
Using equipment performance checklist	41	22
Visual inspection	40	22
Scope	39	21

P

	Paragraph	Page
Packaging Data	6	4
Painting	38	21
Parts, spare	8	5
Patch cord	29*b*	16
Phase modulator, theory	45	27
Power amplifier, theory	48	31
Power output, check	75	49
Preliminary adjustment	18	9
Preliminary starting	21	14
Preventive maintenance:		
Definition	31	17
Exterior	34	17
Forms	33	17
Interior	35	17
Special tools and materials	30	16
Techniques	32	17
Tools and materials	29	16
Purpose and use	3	1

R

	Paragraph	Page
References	APP. I	51
Refinishing	66	46

R (contd)

	Paragraph	*Page*
Repacking	78	50
Replacement of parts:		
Power amplifier tube	64*a*	43
Subminiature tubes	65*b*	45
Retransmission circuits	55	36
Rustproofing	38	21

S

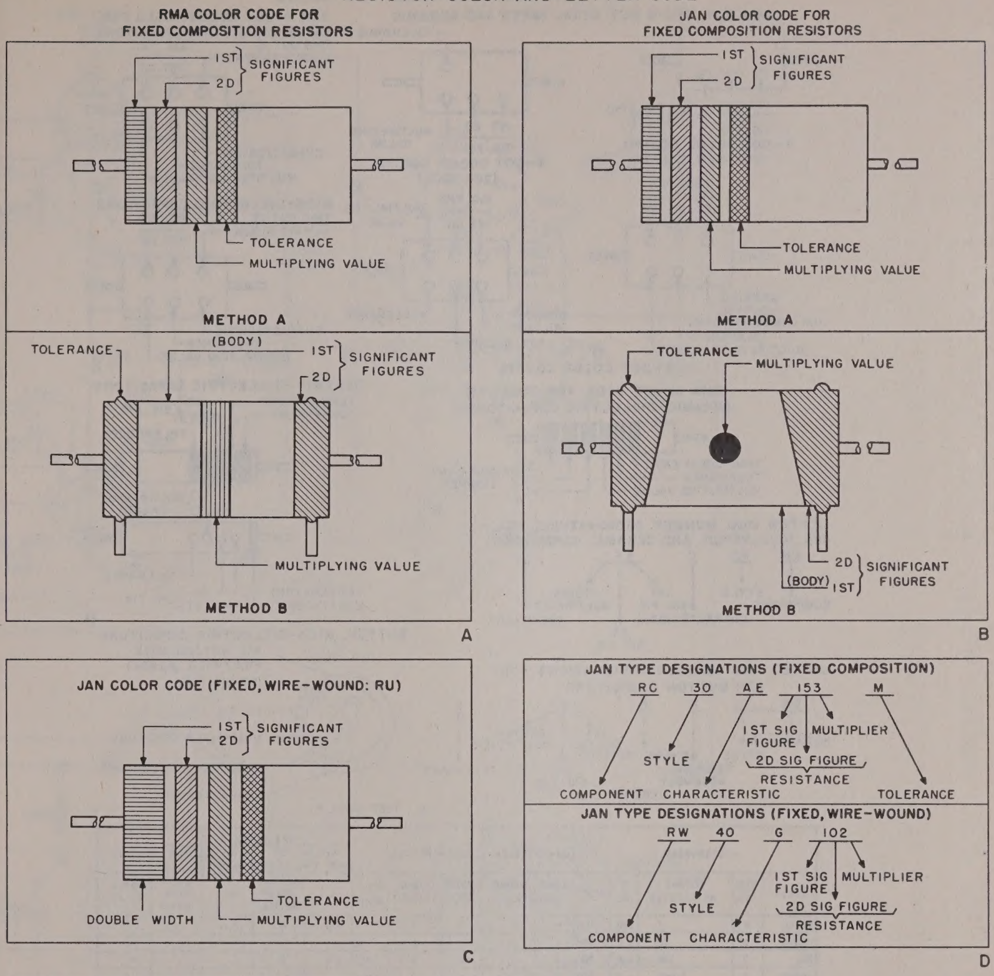
	Paragraph	*Page*
Scope, of instruction book	1	1
Second audio amplifier, theory	52	33
Second doubler, theory	47	28
Service upon receipt of used or reconditioned equipment	14	7
Siting	11	7
Spare parts	8	5
Special repair procedures	65	43
Stopping procedure	23	14
System application:		
Radio Set AN/FRC–15	4*b*	2
Radio Set AN/TRC–22	4*c*	2
Radio Set AN/VRC–6(*)	4*a*	2

T

	Paragraph	*Page*
Technical characteristics	5	4
Test equipment:		
Trouble-shooting	58	39
Theory:		
Buffer	47	28
Crystal oscillator	44	26
First audio amplifier	49	32
First doubler	47	28
Fourth doubler and driver	47	28
Limiter	50	32
Phase modulator	45	27
Power amplifier	48	31
Second audio amplifier	51	32
Second doubler	47	28
Third doubler	47	28
Tools:		
Alinement	30	16
Preventive maintenance	29	16
Trouble shooting:		
At field maintenance level	56	38
At organizational maintenance level	28	16
Checking B+ circuits for shorts	60	40
Component sectionalization	56	38
Data	57	38
D-c resistance of coils and transformers	63	43
General precautions	51	32
Operational test	61	40

	Paragraph	Page
T (contd)		
Procedure	56	38
System sectionalization	56*a*	38
Test equipment required	58	39
Trouble shooting chart	62	40
Visual inspection	40	22
Voltage measurement	62	40
Tuning	19	12
U		
Uncrating, unpacking, and checking new equipment	12	7
W		
Weatherproofing:		
Desert maintenance	37*d*	21
General	37*a*	21
Tropical maintenance	37*b*	21
Winter maintenance	37*c*	21

RESISTOR COLOR AND LETTER CODE


RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS
1ST
2D
SIGNIFICANT FIGURES
TOLERANCE
MULTIPLYING VALUE
METHOD A
TOLERANCE
(BODY)
1ST
2D
SIGNIFICANT FIGURES
MULTIPLYING VALUE
METHOD B
A
JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS
1ST
2D
SIGNIFICANT FIGURES
TOLERANCE
MULTIPLYING VALUE
METHOD A
TOLERANCE
MULTIPLYING VALUE
2D
(BODY)
1ST
SIGNIFICANT FIGURES
METHOD B
B
JAN COLOR CODE (FIXED, WIRE-WOUND: RU)
1ST
2D
SIGNIFICANT FIGURES
TOLERANCE
DOUBLE WIDTH
MULTIPLYING VALUE
C
JAN TYPE DESIGNATIONS (FIXED COMPOSITION)
RC
30
AE
153
M
1ST SIG FIGURE
MULTIPLIER
STYLE
2D SIG FIGURE
RESISTANCE
COMPONENT
CHARACTERISTIC
TOLERANCE
JAN TYPE DESIGNATIONS (FIXED, WIRE-WOUND)
RW
40
G
102
1ST SIG FIGURE
MULTIPLIER
STYLE
2D SIG FIGURE
RESISTANCE
COMPONENT
CHARACTERISTIC
D

STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	—	—
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	—
YELLOW	4	10,000	± 4	—
GREEN	5	100,000	± 5	—
BLUE	6	1,000,000	± 6	—
VIOLET	7	10,000,000	± 7	—
GRAY	8	100,000,000	± 8	—
WHITE	9	1,000,000,000	± 9	—
GOLD	—	0.1	± 5	J
SILVER	—	0.01	±10	K
NO COLOR	—	—	±20	M

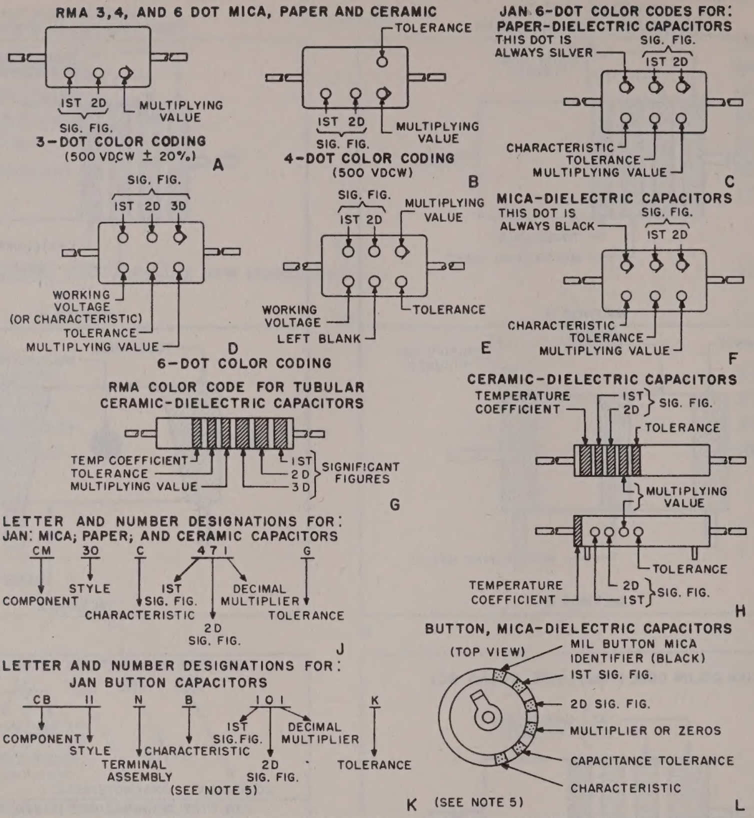
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY - NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 29. Resistor color codes.

CAPACITOR COLOR AND LETTER CODES


RMA 3,4, AND 6 DOT MICA, PAPER AND CERAMIC
1ST 2D
SIG. FIG.
MULTIPLYING VALUE
3-DOT COLOR CODING
(500 VDCW ± 20%)
A
TOLERANCE
1ST 2D
SIG. FIG.
MULTIPLYING VALUE
4-DOT COLOR CODING
(500 VDCW)
B
JAN 6-DOT COLOR CODES FOR:
PAPER-DIELECTRIC CAPACITORS
THIS DOT IS ALWAYS SILVER
SIG. FIG.
1ST 2D
CHARACTERISTIC
TOLERANCE
MULTIPLYING VALUE
C
SIG. FIG.
1ST 2D 3D
WORKING VOLTAGE (OR CHARACTERISTIC)
TOLERANCE
MULTIPLYING VALUE
D
6-DOT COLOR CODING
SIG. FIG.
1ST 2D
MULTIPLYING VALUE
WORKING VOLTAGE
LEFT BLANK
TOLERANCE
E
MICA-DIELECTRIC CAPACITORS
THIS DOT IS ALWAYS BLACK
SIG. FIG.
1ST 2D
CHARACTERISTIC
TOLERANCE
MULTIPLYING VALUE
F
RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS
TEMP COEFFICIENT
TOLERANCE
MULTIPLYING VALUE
1ST
2D
3D
SIGNIFICANT FIGURES
G
CERAMIC-DIELECTRIC CAPACITORS
TEMPERATURE COEFFICIENT
1ST
2D
SIG. FIG.
TOLERANCE
MULTIPLYING VALUE
TOLERANCE
TEMPERATURE COEFFICIENT
2D
1ST
SIG. FIG.
H
LETTER AND NUMBER DESIGNATIONS FOR:
JAN: MICA; PAPER; AND CERAMIC CAPACITORS
CM 30 C 471 G
COMPONENT
STYLE
CHARACTERISTIC
1ST SIG. FIG.
2D SIG. FIG.
DECIMAL MULTIPLIER
TOLERANCE
J
LETTER AND NUMBER DESIGNATIONS FOR:
JAN BUTTON CAPACITORS
CB 11 N B 101 K
COMPONENT
STYLE
TERMINAL ASSEMBLY
CHARACTERISTIC
1ST SIG. FIG.
2D SIG. FIG.
DECIMAL MULTIPLIER
TOLERANCE
(SEE NOTE 5)
K
BUTTON, MICA-DIELECTRIC CAPACITORS
(TOP VIEW)
MIL BUTTON MICA IDENTIFIER (BLACK)
1ST SIG. FIG.
2D SIG. FIG.
MULTIPLIER OR ZEROS
CAPACITANCE TOLERANCE
CHARACTERISTIC
(SEE NOTE 5)
L

- STANDARDS -					JAN MICA-CM		JAN PAPER-CN		JAN CERAMIC-CC						
										CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS			
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-	-	±20	500	-	-	-	-	-	-	-	-	-	-

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%

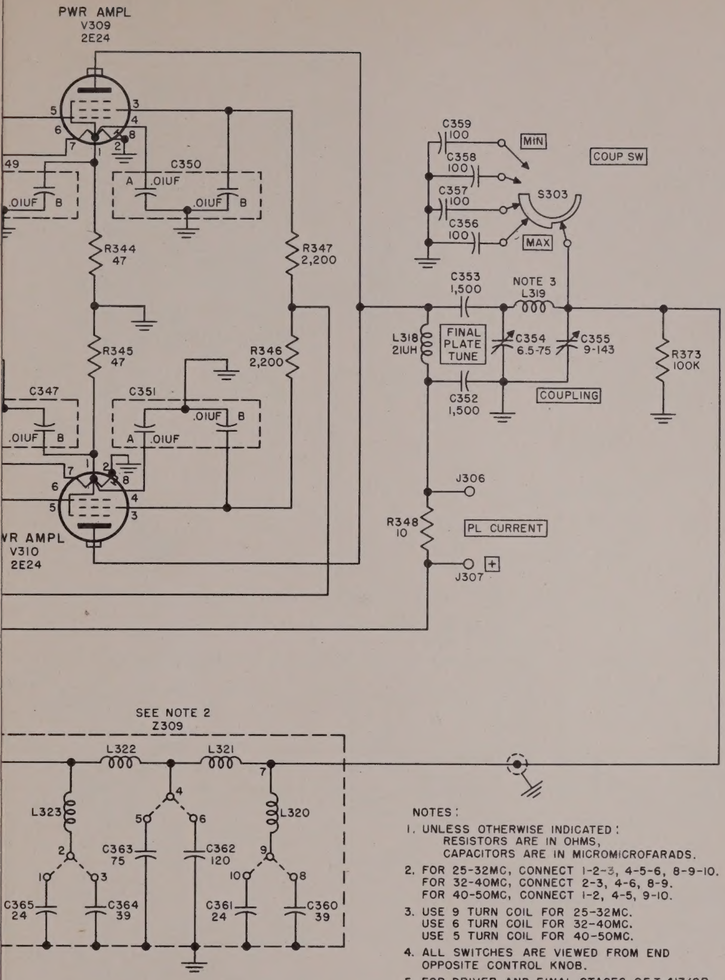
NOTES

JAN: JOINT ARMY-NAVY
RMA; RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC

Figure 30. Capacitor color codes.


PWR AMPL
V309
2E24
3
4
5
6
7
8
1
2
49
.01UF
B
C350
A
.01UF
.01UF
B
R344
47
R345
47
R347
2,200
R346
2,200
C347
.01UF
B
C351
.01UF
B
A
.01UF
7
6
5
1
2
8
4
3
VR AMPL
V310
2E24
C359
100
MIN
C358
100
C357
100
C356
100
MAX
COUP SW
S303
C353
1,500
NOTE 3
L319
L318
21UH
FINAL
PLATE
TUNE
C354
6.5-75
C355
9-143
R373
100K
C352
1,500
COUPLING
J306
R348
10
PL CURRENT
+
J307
SEE NOTE 2
Z309
L322
L321
7
4
L323
5
6
L320
2
C363
75
C362
120
9
1
3
10
8
C365
24
C364
39
C361
24
C360
39

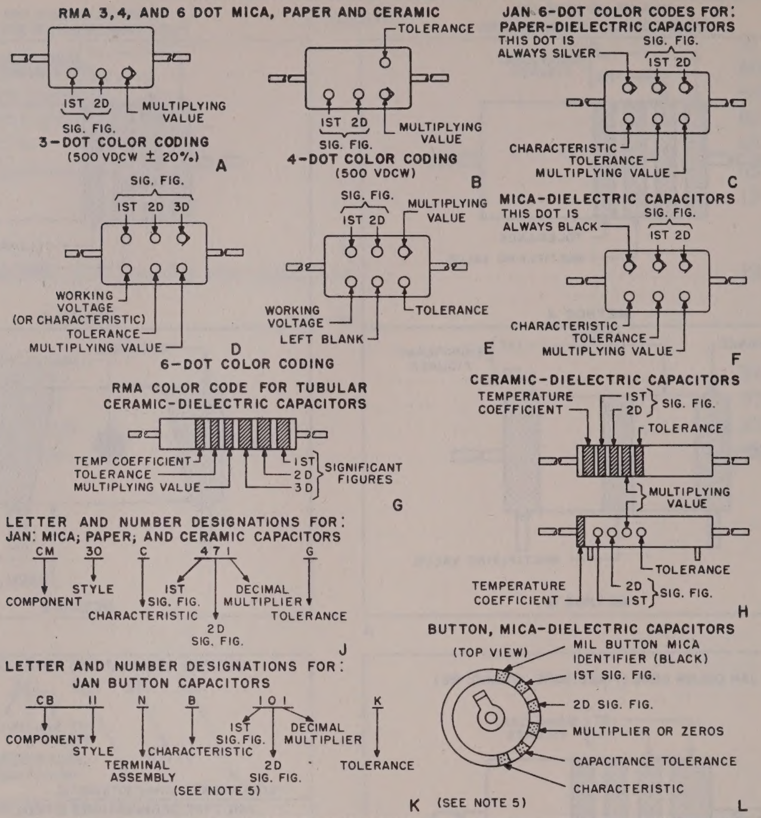
NOTES:

1. UNLESS OTHERWISE INDICATED:
   RESISTORS ARE IN OHMS,
   CAPACITORS ARE IN MICROMICROFARADS.
2. FOR 25-32MC, CONNECT 1-2-3, 4-5-6, 8-9-10.
   FOR 32-40MC, CONNECT 2-3, 4-6, 8-9.
   FOR 40-50MC, CONNECT 1-2, 4-5, 9-10.
3. USE 9 TURN COIL FOR 25-32MC.
   USE 6 TURN COIL FOR 32-40MC.
   USE 5 TURN COIL FOR 40-50MC.
4. ALL SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
5. FOR DRIVER AND FINAL STAGES OF T-417/GR SEE FIGURE TM 804-30.

TM 804-23

Figure 31. Radio Transmitter T–208/U and T–417/GR, schematic diagram.

CAPACITOR COLOR AND LETTER CODES


RMA 3,4, AND 6 DOT MICA, PAPER AND CERAMIC
1ST 2D
SIG. FIG.
MULTIPLYING VALUE
3-DOT COLOR CODING
(500 VDCW ± 20%)
A
TOLERANCE
1ST 2D
SIG. FIG.
MULTIPLYING VALUE
4-DOT COLOR CODING
(500 VDCW)
B
JAN 6-DOT COLOR CODES FOR:
PAPER-DIELECTRIC CAPACITORS
THIS DOT IS ALWAYS SILVER
SIG. FIG.
1ST 2D
CHARACTERISTIC
TOLERANCE
MULTIPLYING VALUE
C
SIG. FIG.
1ST 2D 3D
WORKING VOLTAGE (OR CHARACTERISTIC)
TOLERANCE
MULTIPLYING VALUE
D
6-DOT COLOR CODING
SIG. FIG.
1ST 2D
MULTIPLYING VALUE
WORKING VOLTAGE
LEFT BLANK
TOLERANCE
E
MICA-DIELECTRIC CAPACITORS
THIS DOT IS ALWAYS BLACK
SIG. FIG.
1ST 2D
CHARACTERISTIC
TOLERANCE
MULTIPLYING VALUE
F
RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS
TEMP COEFFICIENT
TOLERANCE
MULTIPLYING VALUE
1ST
2D
3D
SIGNIFICANT FIGURES
G
CERAMIC-DIELECTRIC CAPACITORS
TEMPERATURE COEFFICIENT
1ST
2D
SIG. FIG.
TOLERANCE
MULTIPLYING VALUE
TOLERANCE
TEMPERATURE COEFFICIENT
2D
1ST
SIG. FIG.
H
LETTER AND NUMBER DESIGNATIONS FOR:
JAN: MICA; PAPER; AND CERAMIC CAPACITORS
CM 30 C 471 G
COMPONENT
STYLE
CHARACTERISTIC
1ST SIG. FIG.
2D SIG. FIG.
DECIMAL MULTIPLIER
TOLERANCE
J
LETTER AND NUMBER DESIGNATIONS FOR:
JAN BUTTON CAPACITORS
CB 11 N B 101 K
COMPONENT
STYLE
TERMINAL ASSEMBLY
CHARACTERISTIC
1ST SIG. FIG.
2D SIG. FIG.
DECIMAL MULTIPLIER
TOLERANCE
(SEE NOTE 5)
K
BUTTON, MICA-DIELECTRIC CAPACITORS
(TOP VIEW)
MIL BUTTON MICA IDENTIFIER (BLACK)
1ST SIG. FIG.
2D SIG. FIG.
MULTIPLIER OR ZEROS
CAPACITANCE TOLERANCE
CHARACTERISTIC
(SEE NOTE 5)
L

- STANDARDS -					JAN MICA-CM		JAN PAPER-CN		JAN CERAMIC-CC					
										CAP.TOL.FOR MORE THAN 10 UUF		CAP.TOL.FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARACTERISTIC	LETTER TOL.	CHARACTERISTIC	DEC. MULT.	%	LETTER DESIGNATION	UUF	LETTER DESIGNATION	CHARACTERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-	-	±20	500	-	-	-	-	-	-	-	-	-	-
* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%														

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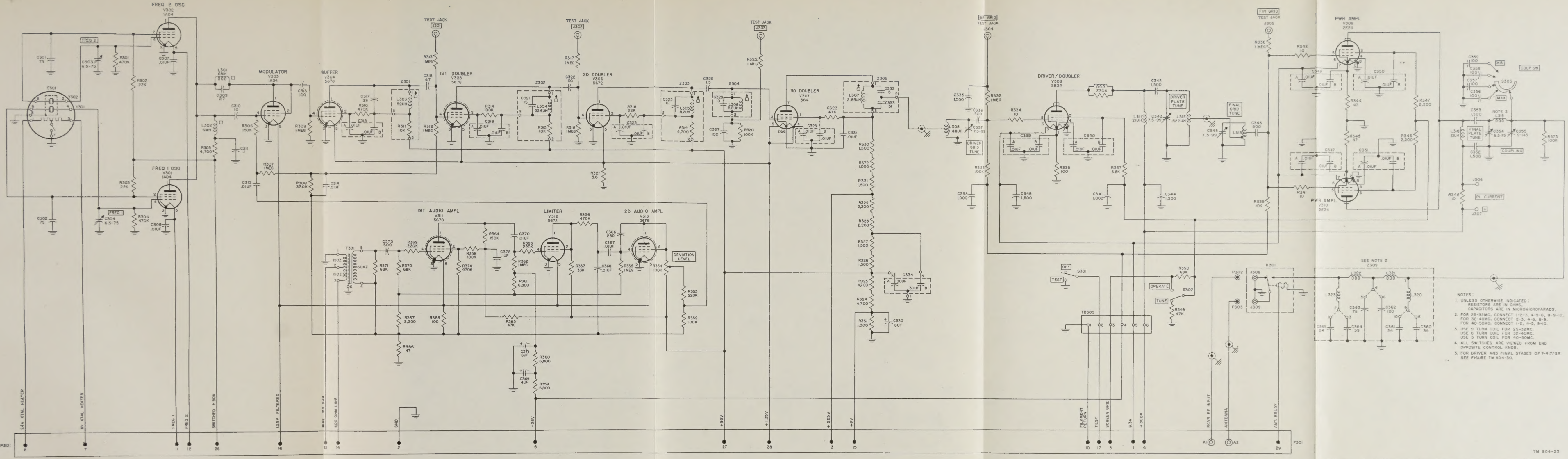
TM CC

Figure 30. Capacitor color codes.


FREQ 2 OSC
V302
1AD4
FREQ 1 OSC
V301
1AD4
E301
MODULATOR
V303
1AD4
BUFFER
V304
5678
1ST DOUBLER
V305
5678
2D DOUBLER
V306
5672
3D DOUBLER
V307
384
DRIVER / DOUBLER
V308
2E24
PWR AMPL
V309
2E24
PWR AMPL
V310
2E24
1ST AUDIO AMPL
V311
5678
LIMITER
V312
5672
2D AUDIO AMPL
V313
5678
TEST JACK
J301
J302
J303
J304
J305
DRIVER GRID TUNE
DRIVER PLATE TUNE
FINAL GRID TUNE
FINAL PLATE TUNE
DEVIATION LEVEL
COUP SW
COUPLING
PL CURRENT
OFF
TEST
OPERATE
TUNE
SEE NOTE 2
Z309
TB305
K301
24V XTAL HEATER
6V XTAL HEATER
FREQ 1
FREQ 2
SWITCHED +90V
135V FILTERED
MIKE 150 OHM
600 OHM LINE
GND
-25V
+90V
+135V
+225V
+2V
FILAMENT RETURN
TEST
SCREEN GRID
6.3V
+380V
RCVR RF INPUT
ANTENNA
ANT. RALAY
P301
TM 804-23

NOTES:

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5. FOR DRIVER AND FINAL STAGES OF T-417/GR SEE FIGURE TM 804-30.

Figure 31. Radio Transmitter T–208/U and T–417/GR, schematic diagram.

F
3D D
OU

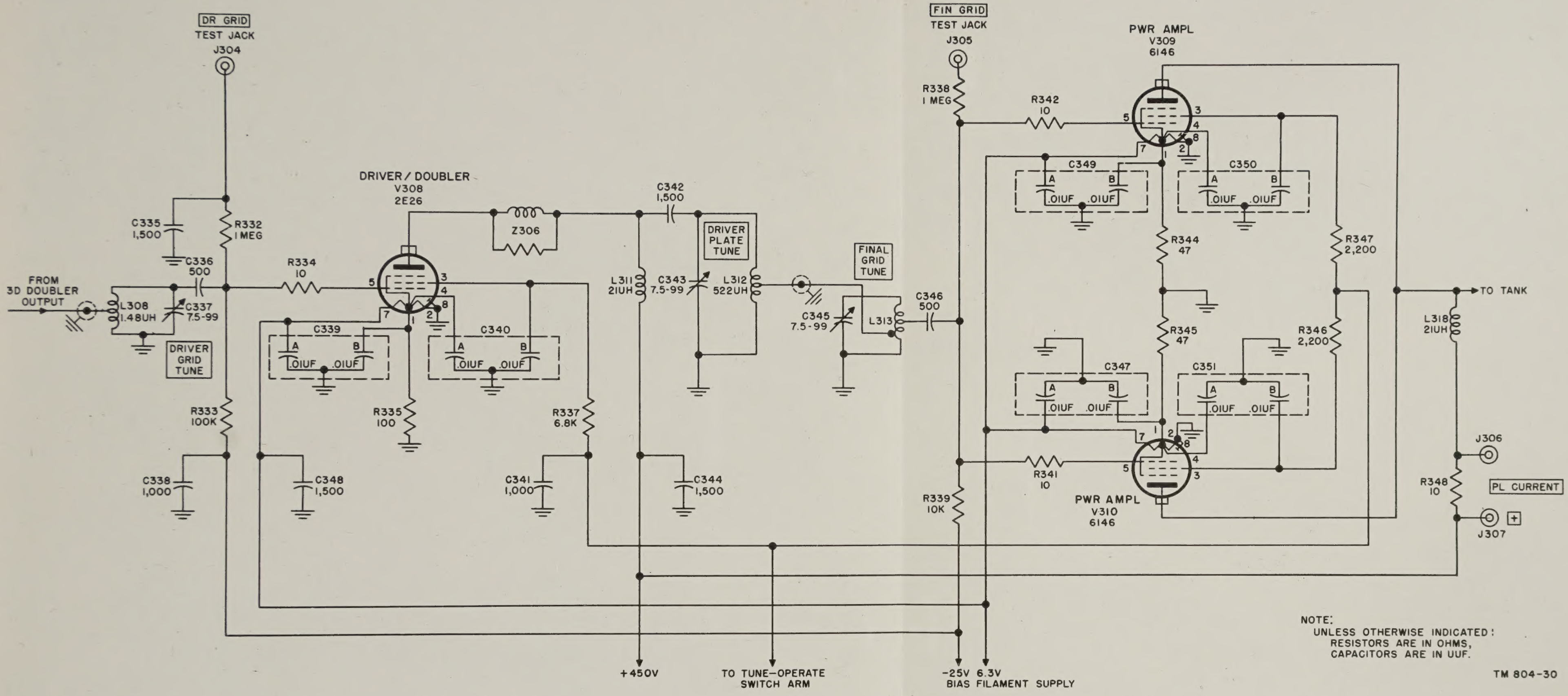
DR GRID
TEST JACK
J304
FROM
3D DOUBLER
OUTPUT
L308
1.48UH
C337
7.5-99
DRIVER
GRID
TUNE
C335
1,500
C336
500
R332
1 MEG
R333
100K
C338
1,000
R334
10
DRIVER/DOUBLER
V308
2E26
C339
C340
A
B
.01UF
R335
100
C348
1,500
Z306
C342
1,500
L311
21UH
C343
7.5-99
L312
522UH
DRIVER
PLATE
TUNE
R337
6.8K
C341
1,000
C344
1,500
FINAL
GRID
TUNE
C345
7.5-99
L313
C346
500
FIN GRID
TEST JACK
J305
R338
1 MEG
R342
10
PWR AMPL
V309
6146
C349
C350
R344
47
R345
47
R347
2,200
R346
2,200
C347
C351
R341
10
R339
10K
PWR AMPL
V310
6146
TO TANK
L318
21UH
J306
R348
10
PL CURRENT
J307
+450V
TO TUNE-OPERATE
SWITCH ARM
-25V
BIAS
6.3V
FILAMENT SUPPLY
NOTE:
UNLESS OTHERWISE INDICATED:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.
TM 804-30

Figure 32. Radio Transmitter T-417/GR, driver and final stage, schematic diagram.